SEALING OF FUEL-INJECTION PUMPS BY ENGINE MANUFACTURERS

VDT-I-400/106-En
8.1978

Destroy VDT-BMP 001/52 of 8.8.1973

The firms listed below obtain basic models of fuel-injection pumps from us and, with our approval, set the full load delivery and speed for various engine types themselves. It may also be the case that the full load delivery of pumps set during production is slightly altered according to engine requirements. In such cases, the seal of the engine manufacturer in question is to be found on our fuel-injection pumps. The markings are listed below.

If a justified guarantee claim is made within the period of warranty the procedure is the same as for pumps sealed by us, i.e. the guarantee case is to be reported in the usual manner with punch cards, written documents or collective guarantee report. Faulty adjustment of fuel-injection pumps sealed by one of the firms listed below should be reported under fault no. 15.

Vehicle manufacturer	Marking (wire seal)			Marking (die seal)
	Front	Front and rear	Rear	
AEC		AEC		—
Albin		ALBIN		—
Alfa Romeo	ALFA		ROMEO	—
Allis Chalmers			29	
			64	
Bolinder-Munktell		VOLVO		—
Büssing		BÜSSING		Bü
Case		CASE		—

Geschäftsbereich KH Kundendienst Kfz-Ausrüstung
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Imprimé en République Fédérale d'Allemagne par Robert Bosch GmbH

Vehicle manufacturer	Marking (wire seal)			Marking (die seal)
	Front	Front and rear	Rear	
Daimler-Benz				
Eicher				—
Eicher				—
				
Fiat				—
GMC				
Hanomag				
Henschel				
John Deere				—
IHC				—
KHD				
Mack				
MAN				
MWM				
Murphy Diesel with MWM engine				—
New Idea Farm Equipment				
Opel				
Manufacturer's seal				
Customer service seal				
Manufacturer's seal for Sweden (Emission standards seal)				
Peugeot, Indenor				—

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Vehicle manufacturer	Marking (wire seal) Front	Front and rear	Rear	Marking (die seal)
Saab - Scania	SCANIA		LT 45	
Schlüter				—
Steyr-Daimler-Puch				STEYR
Südbremse München		SB		—
Volvo				—
Volvo-BM				
Volvo-Penta				—
Volvo and Volvo Penta			No. 343...358	
Waukesha and Waukesha-Scania		W		

A3

New Product

"MW" Diesel Fuel Injection Pump

EP 40
VDT-BEP 102/1 B
<VDT-I-403/1 B>
Edition B. 1974
Translation of
German edition
of 10.7.1974

A new Bosch diesel fuel injection pump, the "MW", is being fitted, together with the "RW" mechanical governor, in the new Daimler-Benz vehicle with a 5-cylinder engine (OM 617).

The fuel injection system consists of the following major components:

Fuel injection pump:	PES 5 MW 55/320 RS 3 PES 5 MW .. RS 4 USA model (green nameplate) MW = pump size M, heavy-duty
Mechanical governor:	RW 350/2200 MW 2 RW = governor with tensioning lever MW = governor for pump size "MW"
Supply pump:	FP/K 22 MW 3 MW = supply pump for pump size "MW"

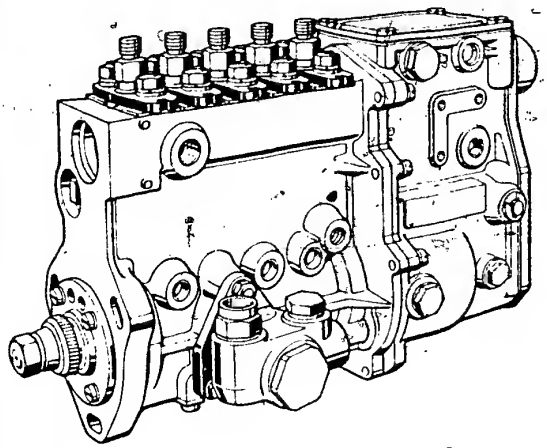

Fig. 1

Construction and Operation

1. Fuel injection pump

The delivery and metering of the fuel ensues according to the familiar working methods of Bosch fuel injection pumps.

The special characteristics and properties of this fuel injection pump are:

- Temperature-resistant, pre-assembled barrel and valve assembly as an independent subassembly.
- Closed die-cast stress-free housing, with base cover.
- The basic adjustment to the fuel delivery is made externally by turning the barrel and valve assembly, and that of the port closing by placing spacers under the holding flange of the barrel and valve assembly.
- Control rod with ball linkage, non-chip metal formed.
- Stiffer camshaft, torsion-proof and resistant to bending. Makes possible high injection pressure and short duration of injection.
- No adjustment of the axial play of the camshaft necessary.
- Maintenance-free through connection to engine lubrication system.
- Choice of mounting position of partly integrated automatic timing device.

A4

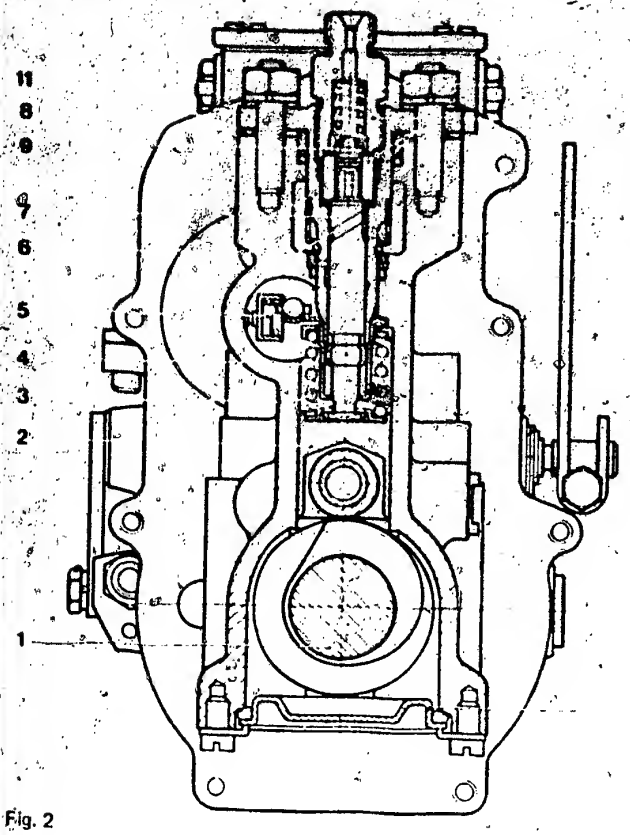

Fig. 2

Notes to Fig. 2

1 = Camshaft
2 = Roller tappet
3 = Helical compression spring
4 = Control sleeve
5 = Control rod
6 = Control edge
7 = Plunger and barrel assembly
8 = Adjusting plate
9 = Delivery valve assembly
10 = Delivery valve spring
11 = Holding flange
12 = Barrel and valve assembly
13 = Control lever
14 = Cover

2. Mechanical governor

The "RW" mechanical governor is a maximum-minimum governor. It can also be produced as variable speed governor type "RWV" for other vehicles.

The special characteristics and properties of this governor are:

- All adjustments can be easily undertaken after removal of the governor end-cover.
- Pneumatic shut-off device controlled by switch in steering column. (Vacuum pump – control valve in steering column switch – pneumatic shut-off device).
- Speed-dependent, mechanical regulation of starting fuel delivery.
- Various possibilities on the upper side of the governor for fitting ancillary devices for characteristic curve correction. (Altitude compensation, manifold pressure compensation, temperature compensation).
- The governor is very powerful and this results in a high degree of regulating accuracy.
- Non-chip metal formed governor parts.
- Flyweight assembly damped against vibration.
- Control lever only needs to exert very low adjusting forces.

Notes to Fig. 3

① = Speed droop adjustment
② = Nominal speed adjustment
③ = Idle adjustment
④ = Full-load adjustment for RWV
5 = Driver
6 = Fulcrum lever
7 = Linkage lever
8 = Follower lever
9 = Control rod
10 = Linkage point
11 = Helical compression spring
12 = Sliding sleeve
13 = Swivel lever
14 = Drive plate
15 = Needle roller bearing
16 = Flyweight
17 = Rubber cushion
18 = Leaf spring
19 = Bell crank
20 = Governor spring
21 = Adjusting shaft
22 = Control lever
23 = Edge cam for RWV
24 = Idle auxiliary spring
25 = Tensioning lever
26 = Driver screw for RWV
27 = Spring retainer for RW
28 = Pneumatic shut-off device

Construction of the "RW" Mechanical Governor

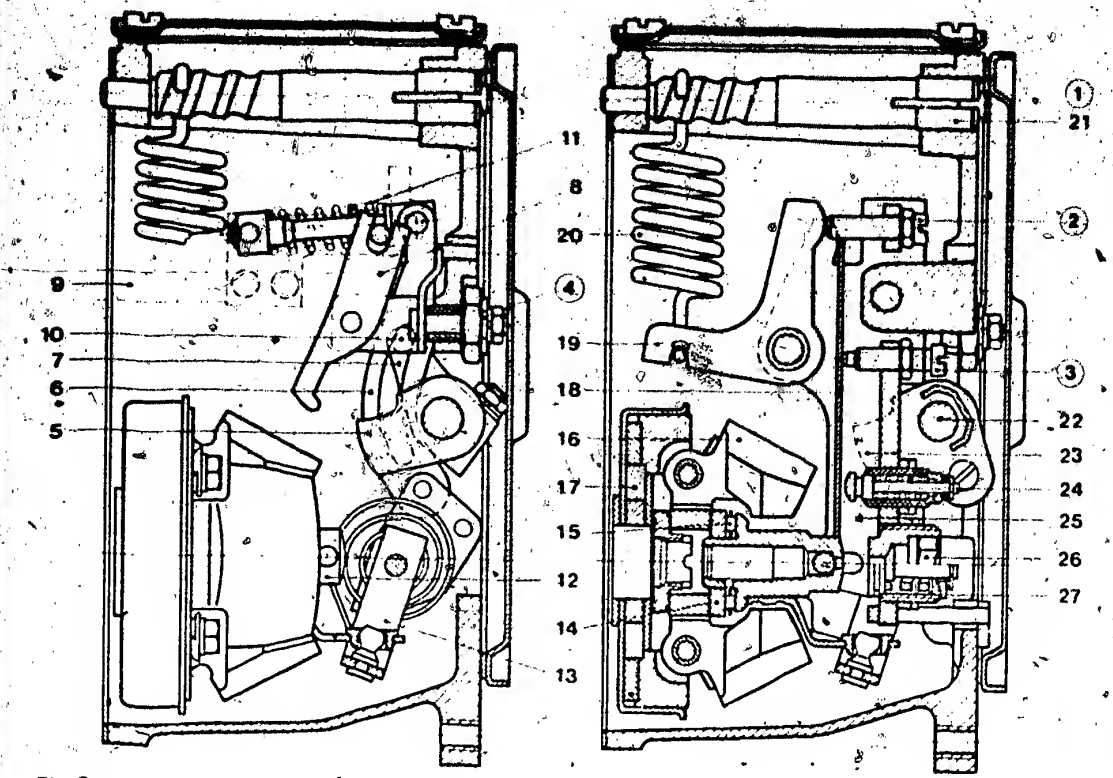

Fig. 3

The flyweight assembly is fastened on the camshaft of the fuel injection pump together with a vibration damper.
When the 4 flyweights 16 swing outwards they push the sliding sleeve axially via a drive plate 14 and needle roller bearing 15.

The tensioning lever 25 is swivel-mounted on a bolt in the housing. It carries an adjustable bell crank 19, to which is attached the governor spring 20, with which the nominal speed can be adjusted ② . The upper loop of the governor spring is looped over the adjusting shaft 21 and serves to adjust the speed droop ① . Apart from this, an adjustable leaf spring 18 and an idle auxiliary spring 24 are mounted on the tensioning lever 25 to adjust the idle speed ③ . Idle adjustment does not influence the nominal speed.

The movement of the sleeve is transferred to the fulcrum lever 6 and the control rod 9 of the fuel injection pump via the swivel lever 13 mounted in the housing. The linkage lever 7, which is fixed to the external control lever 22, fits in the slit in fulcrum lever 6. During acceleration the lever advantage of linkage lever 13 to control rod 9 alters via control lever, 22 and linkage point 10 of the linkage lever 7. Between the idle and maximum speeds the position of the control rod and hence the quantity of fuel injected can be directly selected by the control lever 22. Full-load delivery is adjusted by means of the external stop of the control lever 22.

Regulation of the starting fuel delivery is speed-dependent.

Starting fuel delivery is only possible below idle speed and takes place when the follower lever engages with the driver 5.

A spring retainer 27 in the tensioning lever 25 ensures fuel quantity compensation.

Diagramatic view of RW Mechanical Governor

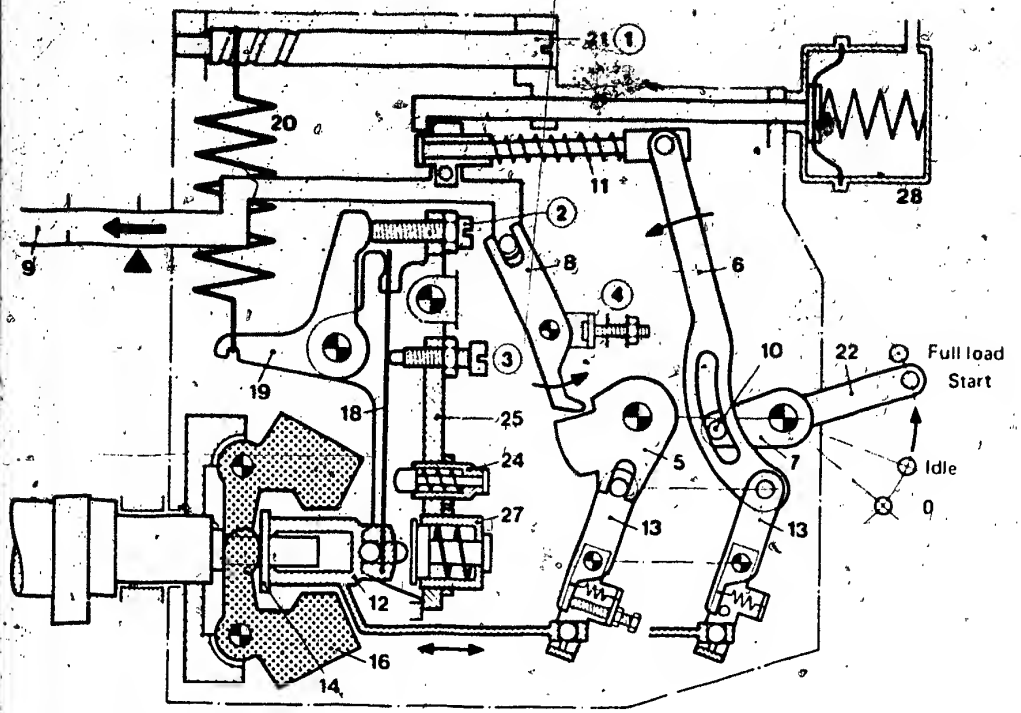

Fig. 4 Starting position

Notes to Fig. 4

① = Speed droop adjustment
② = Nominal speed adjustment
③ = Idle adjustment
④ = Full-load adjustment for RWV
5 = Driver
6 = Fulcrum lever
7 = Linkage lever
8 = Follower lever
9 = Control rod
10 = Linkage point
11 = Helical compression spring
12 = Sliding sleeve
13 = Swivel lever
14 = Drive plate
16 = Flyweight
18 = Leaf spring
19 = Bell crank
20 = Governor spring
21 = Adjusting shaft
22 = Control lever
24 = Idle auxiliary spring
25 = Tensioning lever
27 = Spring retainer for RW ...
Driver screw for RWV (not shown)
28 = Pneumatic shut-off device

The difference between the RWV and RW governors is that on the RWV-type the linkage point 10 on the linkage lever 7 is controlled by a special torque cam.

When accelerating or pushing the control lever forwards, the control rod is at once pushed in the "more fuel" direction, until follower lever 8 contacts the edge cam 23 (full-load stop). When the control lever or linkage lever 7 is pushed further forward then the helical compression spring 11 is compressed. As speed increases, the compression on the spring decreases. When the desired speed is attained, then the control rod is pulled back and effects speed regulation.

Fuel quantity compensation is effected not by means of the spring retainer 27 but through the curve on the (speed-dependent) edge cam, which is sensed by the follower lever 8.

After-Sales Service Note:
After-sales service follows normal lines for this series of pumps and governors. Technical workshop documentation as well as testing and repair tools will be placed at your disposal.

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Geschäftsbereich KH
Kundendienstschule

New product

PE(S) . . MW . .

VDT-I-403/2 En
7.1978

Combined atmospheric and manifold-pressure compensator (ALDA)

Technical information sheet VDT-I-403/1 En describes how the diesel fuel-injection pump PE(S) . . MW . . with governor RW . . MW . . works.

As a new variation of this pump combination a model has been designed with combined atmospheric and manifold-pressure compensator.

1. Combined atmospheric and manifold-pressure compensator (ALDA)

With pressure-charged engines, the full-load delivery is determined by a changeable i.e. manifold-pressure dependent air-charge in the engine cylinders. In the lower rotational-speed range the air charge in the engine cylinders is less and the full-load delivery must be adjusted correspondingly to the reduced air charge.

The air charge in the individual engine cylinders is dependent, however, not only on the charge-air pressure but also on the respective atmospheric pressure.

Both pressures together (charge-air pressure and atmospheric pressure) give the combined (absolute) pressure.

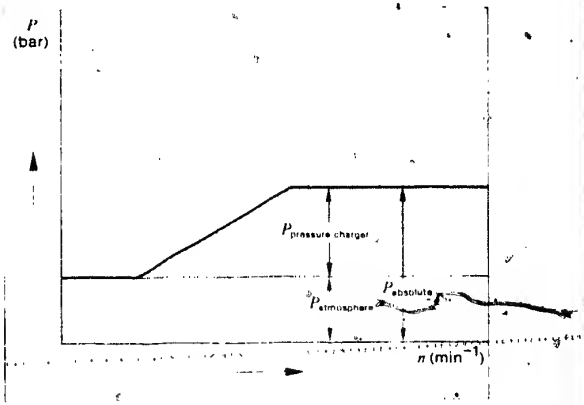

Fig. 1

As can be seen from the diagram (fig. 1), above the respective atmospheric pressure the air is compressed by the engine pressure-charger.

The result is that the prevailing pressure in the intake manifold becomes the absolute pressure.

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2. The function of the ALDA

The absolute pressure (atmospheric pressure + charge-air pressure) from the intake manifold of the engine affects the aneroid capsules of the ALDA aneroid box (147).

The correcting linkage (120) is positively connected to the aneroid capsules.

The linkage lever (39) of the governor linkage is connected to the template of the correcting linkage and to the fulcrum lever (6) of the governor linkage in such a way that it can move. All movements of the aneroid capsules are therefore transferred to the control rod via the correcting linkage, the template, the reverse-transfer lever and the fulcrum lever.

The more the control lever (8) is pushed towards idle, the nearer the bearing point of the linkage lever in the template moves towards the pivot (A) of the template.

The effect of the ALDA-control decreases the more the control lever is moved in the idle direction.

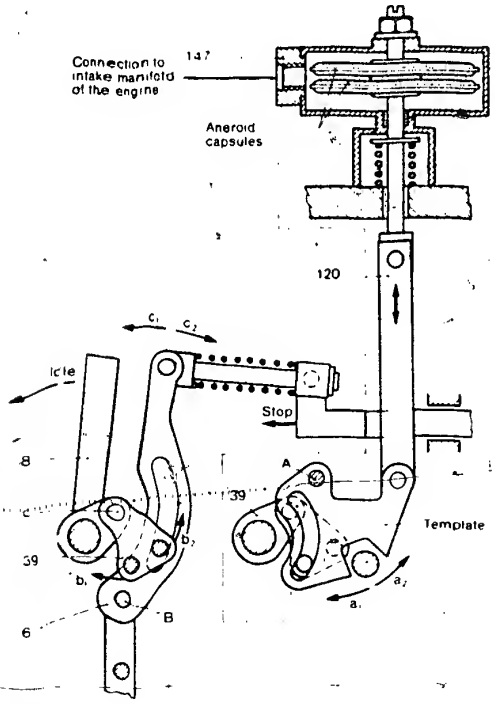


Fig. 2

When the control lever is in idle the effect of the ALDA-control approaches nil.

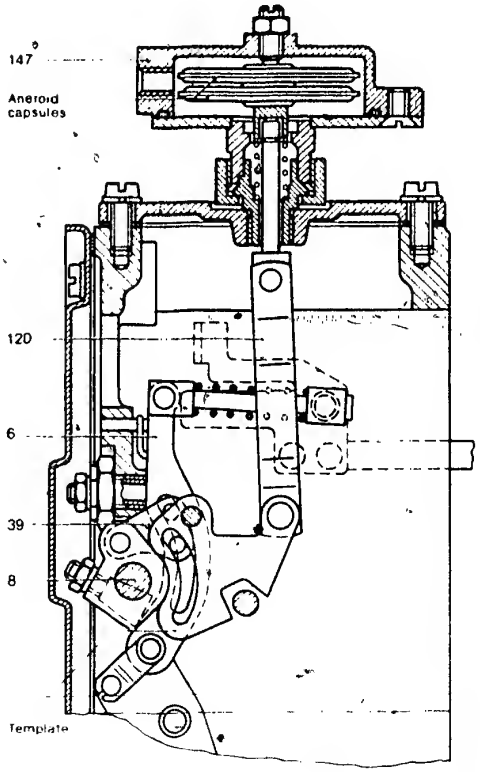
When the absolute pressure falls the aneroid capsules change in length, i.e. they expand. The correcting linkage is pressed downwards. The template thereby moves around the pivot (A) in the direction a_1.

The linkage lever swings around the pivot (C) in the direction b_1.

This causes the fulcrum lever to move around the pivot (B) in the direction C_1.

The control rod is moved in the direction "less delivery".

When the absolute pressure increases (higher air and/or charge-air pressure) the movement takes place in the opposite direction.



A = Pivot template
B = Pivot fulcrum lever
C = Pivot linkage lever
6 = Fulcrum lever
8 = Control lever with setting shaft
39 = Linkage lever
120 = Correcting linkage
147 = Aneroid box

Fig. 3

DIESEL KIKI FUEL-INJECTION PUMPS AFTER-SALES SERVICE PROCEDURE

General

Diesel Kiki Co. Ltd. (DKKC) with headquarters in Tokyo is one of the leading original-equipment manufacturers of the Japanese automobile industry in the diesel injection sector and produces, among other things, distributor-type and in-line fuel-injection pumps (types VE and A) under Bosch licence.

To guarantee the after-sales service and the supply of service parts, Robert Bosch GmbH and Diesel Kiki Co. Ltd. have agreed to perform the after-sales service on DKKC injection systems in Europe through the Bosch After-Sales Service Organization.

Scope of service

The after-sales service covers the entire fuel-injection system (pump, governor, nozzle-and-holder assembly, filter) of all passenger cars, estate cars (station-wagons), vans and engines which have been exported to Europe.

The after-sales service for DKKC-equipped commercial vehicles and construction machinery which are exported to Europe only in small numbers will continue to be performed by the vehicle/construction machinery manufacturers.

Technical Bulletin

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Geschäftsbereich KH Kundendienst Kraftfahrzeug-Ausrüstung

Special service tools

The sale of special service tools will be performed by RG/AV. Inclusion of the DKKC service tools in the tool program is in preparation.

Replacement products/service parts

The DKKC products and service parts will be sold through the usual channels like all KH products and service parts. The products and service parts will be stocked at KH in Karlsruhe and at the European RG/AVs and have all been recoded to BOSCH Part Numbers.

Training

Integration of DKKC assemblies in RG/AV training courses.

Warranty procedure

Procedure as for RB products through RG/AV.

DKKC-equipped vehicles

See also microfiche AA-83 (08.84)

Isuzu	KBD (Pickup) Trooper UBS (off-road vehicle) WFR 51 (van)
Mazda	626 D E 2200 (van)
Mitsubishi	Colt 1800 GL Lancer 1800 GL Galant 1800, 2300 Pajero 2300 L 300

Nissan-Datsun Bluebird
Laurel
Patrol (hardtop and station)
Urvan
Pickup, UP

Technical documentation

All necessary documentation will be integrated in the Bosch documentation system.

Equipment microfiche	AA..	Distributed 8/84
Service-parts lists	EP 397, 398, 399	Distributed 8/84
Cross-reference	HB 30	Distributed 8/84
Test specifications	WP Distribution when ready through DKKC	
Testing and repair instructions	W-40./...(SIS) W-46./...(SIS) Distribution when ready through DKKC	
Trouble-shooting instructions for vehicles with DKKC injection pumps	Distribution when ready through DKKC	

Note

The previous original DKKC microfiches will in future be reduced to just a few microfiches. Since the DKKC pumps are virtually identical with BOSCH pumps, the contents will be restricted to assemblies which differ from Bosch injection pumps or which are purely DKKC-specific.

Published by:

Robert Bosch GmbH
Division KH-
Technical After-Sales Service (KH/VKD2)

Please direct questions and comments concerning the contents to our authorized representative in your country.

THERMAL-PROTECTION DISCS - REPLACEMENT
on nozzle holders - fitting in passenger cars

THERMAL-PROTECTION SLEEVES - REPLACEMENT
on nozzle holders - fitting in trucks

VDT-I-Gen. 034 En
3.1981

Thermal-protection discs are being fitted with success in order to reduce the coking-up of throttling-pintle nozzles. In addition, the fitting of such discs results in a noticeable reduction in the temperature of the nozzle base. This means that the service life of the nozzle is increased.
In the case of direct-injection engines, and in particular with pressure-charged models, the temperature at the nozzle-body tip rises due to the high combustion-chamber temperatures. This leads to a softening of the nozzle seat and a shortening of nozzle service life. The fitting of thermal-protection sleeves results in the temperature at the nozzle-body tip being reduced which leads to a reduction in the degree of "softening" and hence an increase in service life of the nozzle.

Practically every engine manufacturer fits thermal-protection discs or sleeves in order to protect the nozzles from the effects of excessive heat.

These discs and sleeves are to be replaced as a matter of course every time the nozzle is removed and refitted. Damaged or distorted discs or sleeves can lead to the nozzle being overheated and, in some cases, to it jamming.

The thermal-protection discs are only to be fitted in a particular position, this must be adhered to under all circumstances. The fitting position of the discs is described in our After-Sales Service Instructions "Vehicle-related ... VDT-W-460/...".
Discs and sleeves which are not BOSCH products must be obtained from the vehicle manufacturer.
If original equipment from BOSCH (e.g. VW), the disc 1 410 501 072 is used for DN...S nozzles and KCA nozzle holders. For DLLA...S nozzles (i.e. IH-Neuss) the sleeve 2 430 422 005 is used.

Please take steps to ensure that these discs and sleeves are in stock for the vehicles with which you are mostly concerned.

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by Robert Bosch GmbH D-7 Stuttgart 1 Postfach 50 Printed in the Federal Republic of Germany
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MIXING DIESEL FUEL WITH GASOLINE

VDT-I-Gen. 045 En

11.1981

Procedure

At temperatures below 0° C diesel fuel can precipitate paraffin, depending on its composition. These paraffin crystals block up the fuel filter. This leads to starting problems and even to vehicle failure.

To prevent the precipitation of paraffin, regular gasoline is mixed with diesel fuel in practice.

Danger of explosion

By adding carburetor fuel to diesel fuel ignitable mixtures can occur in the fuel tank under certain conditions.

Instructions

When adding gasoline to diesel fuel the maximum values given by the vehicle manufacturer must always be observed and adhered to.

Effects on our products

As regards wear and for viscosity reasons our products can withstand a mixture of max. 30% gasoline to diesel fuel.
Since the maximum values of the vehicle manufacturers lie below this figure, a negative effect on the quality or the service life of our products is not reckoned with.

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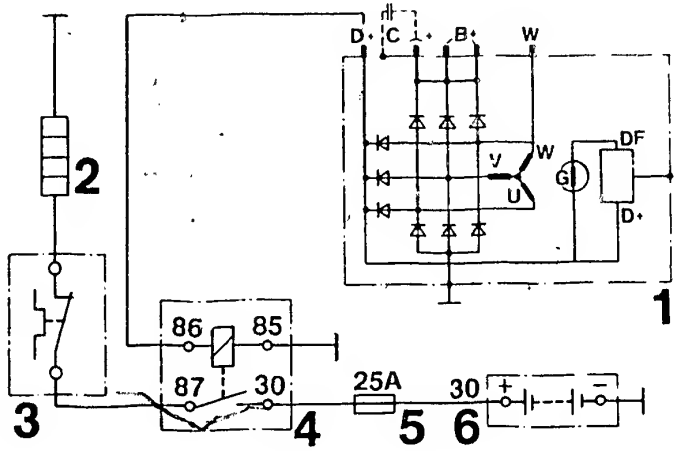
VDT-I-KFZ 101 En
01.86
Supersedes Ed. 11.85
KFZ 002

ELECTRIC DIESEL PREHEATER

Trouble-shooting for retrofit kit



1 = Alternator
2 = Heating element
3 = Thermo-time switch
4 = Switching relay
5 = Fuse 25 A
6 = Battery

These instructions describe the checking of the retrofittable electric diesel preheater 1 457 001 003, which is installed between fuel-filter cover and filter.

Motor Vehicle Service Information

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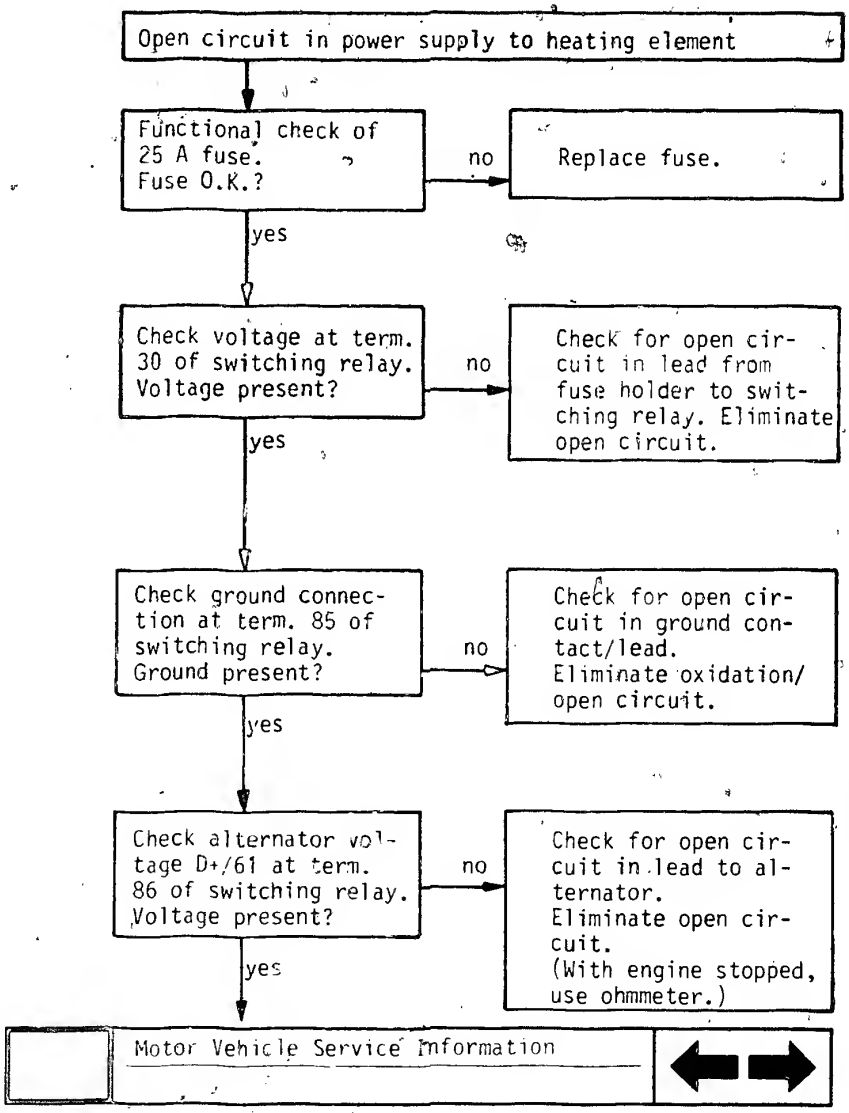
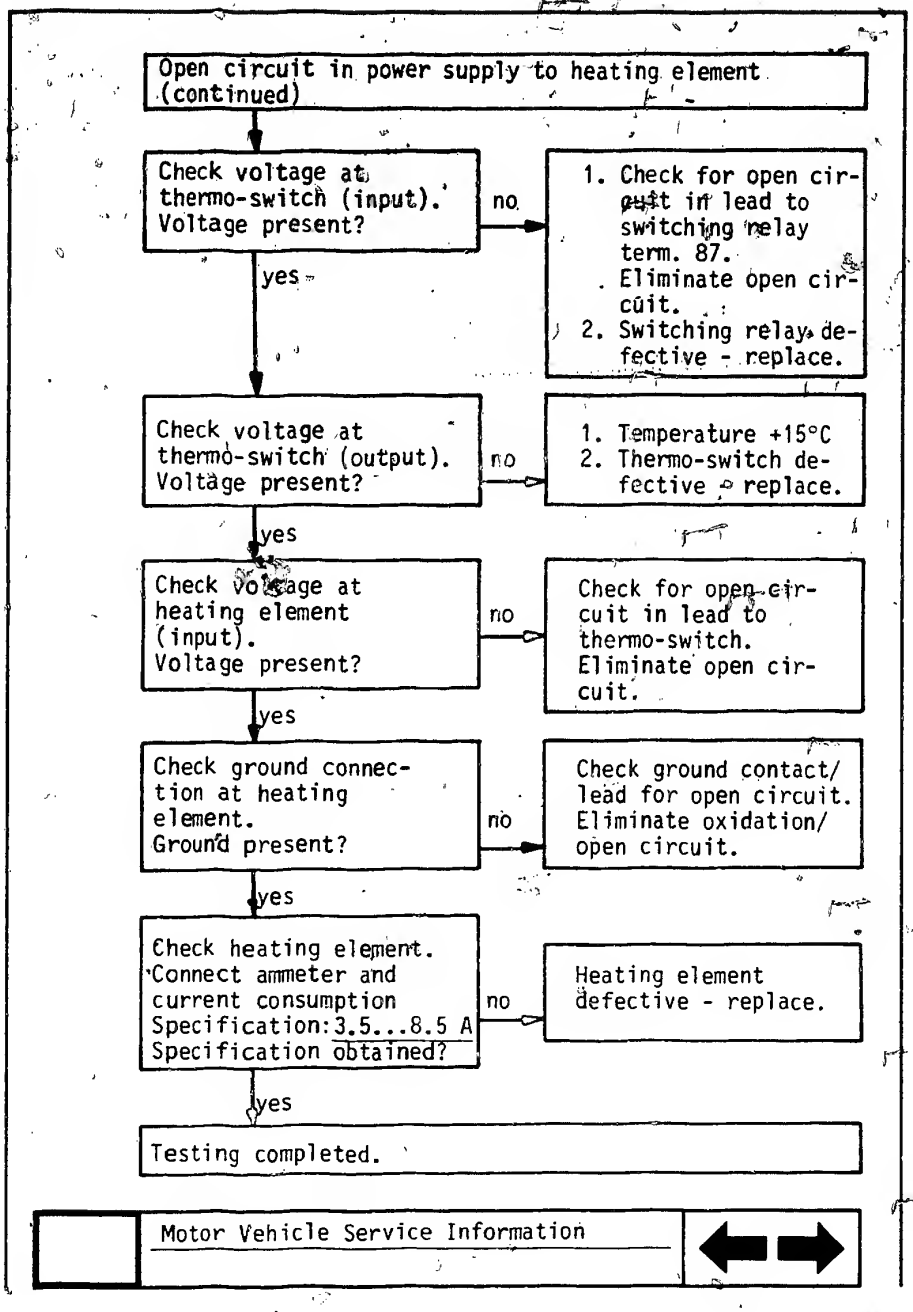
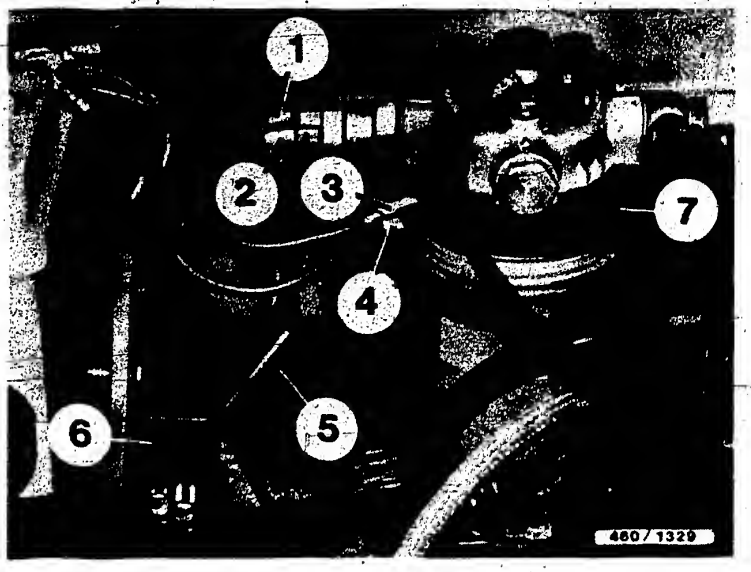
Checking of diesel heater

Fault symptom: Engine starts poorly and/or stops while driving.



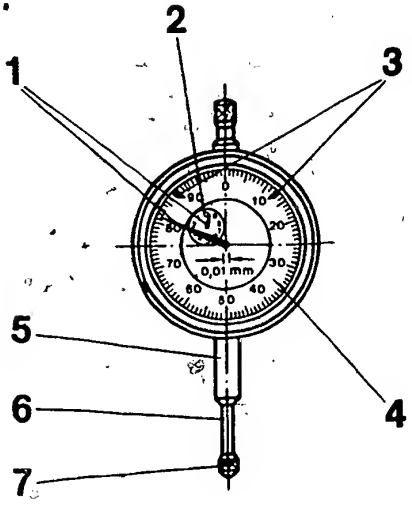

Open circuit in power supply to heating element (continued)
Check voltage at thermo-switch (input). Voltage present?
no
1. Check for open circuit in lead to switching relay term. 87. Eliminate open circuit.
2. Switching relay defective - replace.
yes
Check voltage at thermo-switch (output). Voltage present?
no
1. Temperature +15°C
2. Thermo-switch defective - replace.
yes
Check voltage at heating element (input). Voltage present?
no
Check for open circuit in lead to thermo-switch. Eliminate open circuit.
yes
Check ground connection at heating element. Ground present?
no
Check ground contact/ lead for open circuit. Eliminate oxidation/ open circuit.
yes
Check heating element. Connect ammeter and current consumption Specification: 3.5...8.5 A Specification obtained?
no
Heating element defective - replace.
yes
Testing completed.
Motor Vehicle Service Information



1 = Thermo-switch (input)
2 = Thermo-switch (output)
3 = Heating element (input)
4 = Heating element (output)
5 = Fuse holder
6 = Switching relay
7 = Heating element

Please direct questions and comments concerning the contents to our authorized representative in your country.

TESTING OF DIAL INDICATORS



1 = Pointer
2 = mm indicator
3 = Adjustable tolerance marks
4 = Graduated scale
5 = Clamping stem
6 = Measuring pin
7 = Measuring insert

To increase the adjustment accuracy when working with dial indicators (e.g. timing of fuel-injection pump to engine or setting of injection pumps on injection-pump test bench), it is necessary to subject dial indicators that are in use to an annual check.

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This check consists of a visual examination and a functional test.

Preparations for the testing of dial indicators

* Clean the dial indicator (no oil/grease on measuring pin).
* Visual examination for damage, sharp edges and burrs, corrosion.
* Repair of minor damage with oil stone, lapping paper, rust remover and prepared chalk.
* Keep dial indicator and test equipment at room temperature for at least 30 minutes to equalize temperature.

Check the dial indicator for:

* Readability of graduated scale and numerals.

* Pointer advance in rest position at least 1/10 revolution before zero.

* Pointer overrun at least 1/10 revolution beyond indication range.

* Pointers and graduations must be straight, well-defined and of equal width.

* Rotatability of graduated scale.

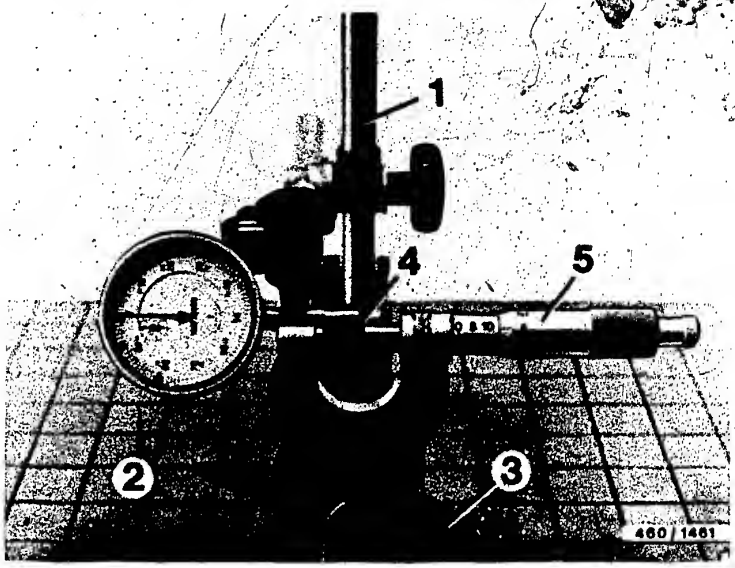
* Check measuring insert for damage (scratches) and wear. Replace if necessary.

* Freedom of movement of measuring pin in clamping stem. The pointers must not graze and must follow the movement of the measuring pin without delay.

* Tolerance marks present and not damaged. Replace if necessary.

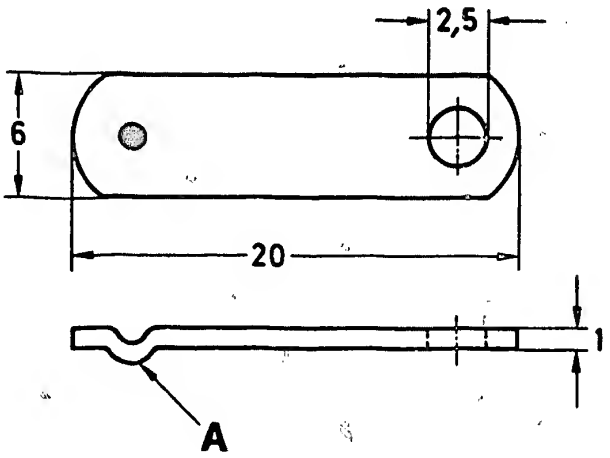
Note:

In case of complaints which cannot be repaired out, replace dial indicator.



1 = Dial-indicator holder (magnetic)
2 = Marking-out plate
3 = Measuring-instrument holder (e.g. Hahn & Kolb Stuttgart no. 31 415 010)
4 = Measuring stop (user-fabricated)
5 = Micrometer screw

Test setup

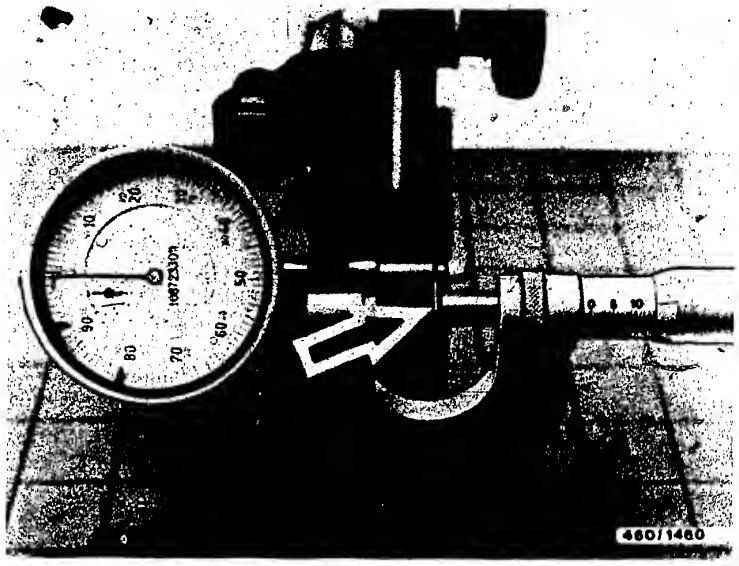


A = Measuring tip

Measuring stop (user-fabricated)

Note on fabrication:
Make measuring tip by means of rivet or blow with center punch.

Dimensions given in mm.



Functional test

Clamp dial indicator in magnetic holder (vertically in the case of dial indicators without spring reset).

Secure measuring-instrument carrier on marking-out board with adhesive tape at either side and clamp micrometer screw parallel to dial indicator.

Insert measuring stop between measuring insert and pin (arrow).

Unscrew measuring spindle of micrometer screw, depending on measuring range of dial indicator.

Preload dial indicator to "0" and, by screwing in the measuring spindle, go through the measuring range of the dial indicator.

When testing, set pointer and graduated mark on dial indicator to overlap millimeter by millimeter and read off the deviation on the vernier of the micrometer screw.

Maximum reading errors for dial indicators that are in use should be taken from the following table.

Measuring range

0...1mm	0...3mm	0...10mm	0...30mm
0.02mm	0.025mm	0.03mm	0.04mm

Static error of measured value

Check static error at two points within the measuring range.
Move to measuring point with measuring pin going in and with it going out, and measure the difference.

Allowable deviation for:
Measuring range 0...10mm : 0.01mm
0...30mm : 0.015mm

Note:
Allowable deviations do not correspond to DIN standard. If the reading error is exceeded, repair or replace dial indicator.

Please direct questions and comments concerning the contents to our authorized representative in your country.

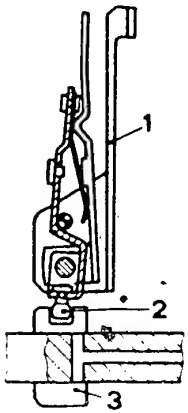
UNEVEN IDLE (ENGINE MISFIRE)

Distributor-type fuel-injection pump VE..F..

Complaints are occasionally being received concerning a variety of different vehicles (e.g. Fiat Ritmo). The complaints are about uneven idle or engine misfire.
The cause of the changes in engine speed during normal operation (i.e. engine misfire) can be a loose ball pin in the fulcrum lever.
In order to repair, the fulcrum lever must be removed and the ball pin (2) checked to ensure that it is seating firmly.

Instructions for checking the ball pin:

Remove the fulcrum lever (1) and check the ball pin (2) for firm seating. If the ball pin is loose, fit a new fulcrum lever and ball pin.



1 = Fulcrum lever (Pos'n. 95)
2 = Ball pin
3 = Control collar

A26

DISTRIBUTOR FUEL-INJECTION PUMP VE.. F..

VDT-I-Gen. 062 En
2.1984
Supersedes Ed. 12.1983

Complaints regarding idle shake and/or black smoke

With individual vehicles fitted with VE-distributor pumps, complaints may arise concerning "idle shake" and/or "black smoke".

1. Idle shake and black smoke

If such complaints are received, first of all the delivery valves are to be checked, and damaged or broken valves replaced

The following pointers are given as an aid to trouble-shooting:

If the delivery valve is broken it delivers too much fuel from the outlet in question. The magnitude of this excessive quantity can only be determined on the test bench.

If the injection lines are disconnected one after another from the nozzle holders, the outlet with the broken delivery valve can be localised. This is because the disconnection of the outlet which is delivering too much fuel results in a far more pronounced speed drop than is the case with the intact delivery valves.

The delivery valves can be replaced in the vehicle if it is possible to tighten them with the specified torque of 40 Nm + 2 Nm (see also VDT-I-460/132, 2.1984).

If the idle shake has been cured by these measures, but not the black smoke at full load, then the measures detailed in the following paragraph are to be carried out.

2. Black smoke

If complaints are received about black smoke, this can be caused by the delivery quantity having increased by 2...3 cm^3/1000 strokes.

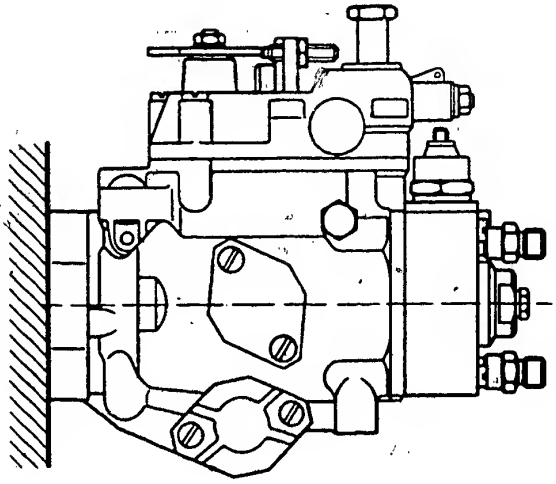
It is not necessary to remove the pump in order to cure this fault. It suffices if the full-load adjusting screw is screwed out by about 0.2 mm (approx. 1/4 turn). The screw is then to be sealed again with locking paint/varnish.

The work detailed above is to be carried out free of charge within the warranty period, and warranty-processing will be in the normal manner.

Please direct questions and comments concerning the contents to our authorized representative in your country.

BOSCH
Geschäftsbereich KH Kundendienst Kfz-Ausrüstung

BLEEDING OF DISTRIBUTOR-TYPE FUEL-INJECTION PUMPS VE..F..

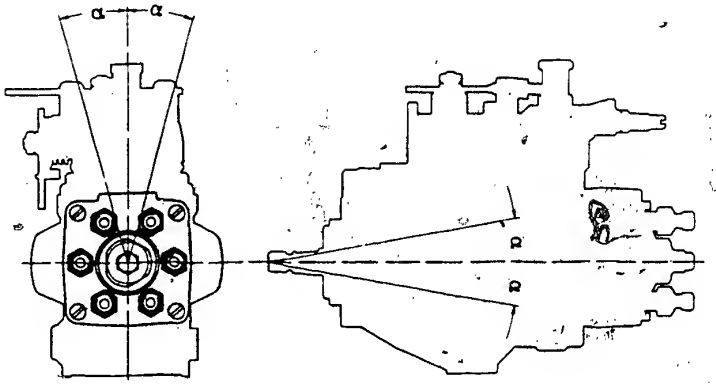


If distributor-type fuel-injection pumps are mounted on the engine, always fill injection pump and fuel filter with fuel.

Horizontally (see picture) mounted distributor-type fuel-injection pumps do not need to be bled since the fuel overflow forms the highest point on the distributor-type pump, and the air in the distributor-type pump is forced back to the tank.

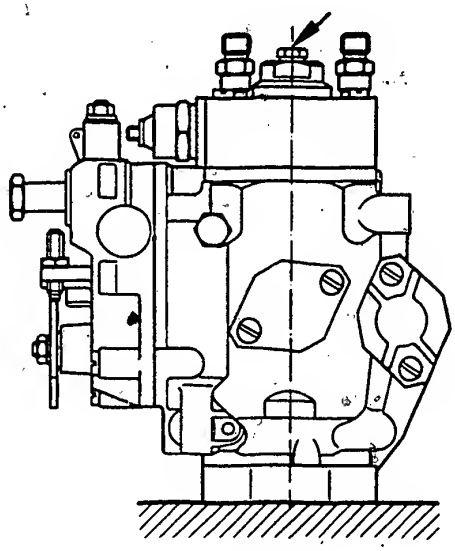
BOSCH

Geschäftsbereich KH Kundendienst Kraftfahrzeug-Ausrüstung



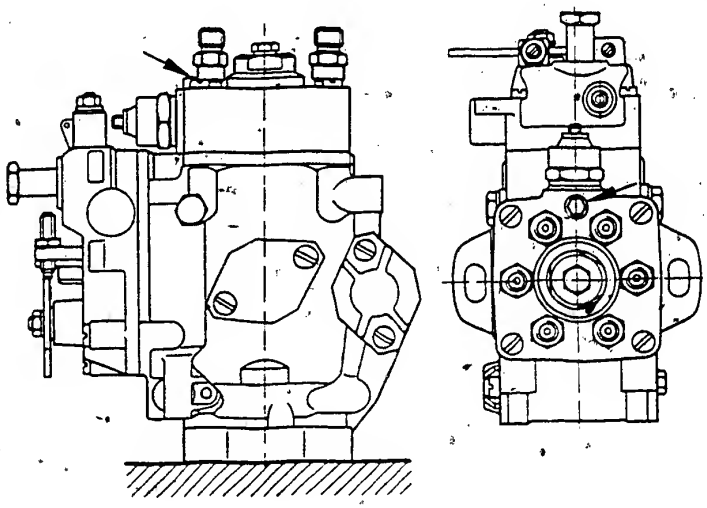
a = Angle of inclination

If the installation position differs by more than 45° (see picture) from the horizontal, then in most cases it will be necessary to bleed the distributor-type fuel-injection pump.



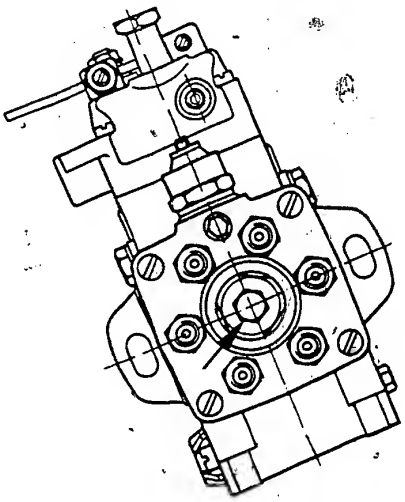
1. Vertical installation

To bleed vertically installed distributor-type fuel-injection pumps, open hexagon screw in central screw plug of hydraulic head (see picture, arrow) until flat place on thread becomes visible. Operate starting motor until fuel escaping at this point is free of bubbles; then re-tighten hexagon screw.



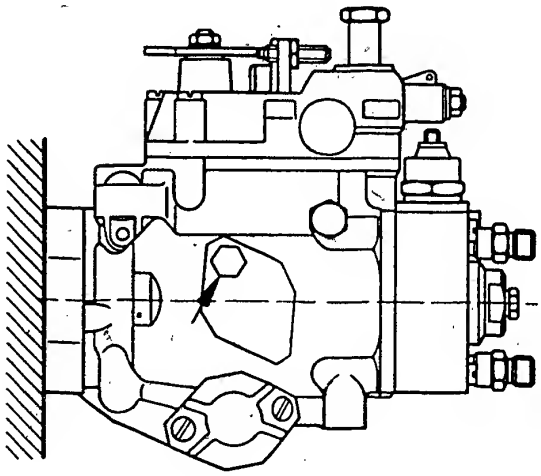
In various versions of distributor-type fuel-injection pump (VE), a hexagon-socket-head cap screw is positioned below the solenoid-operated valve (see picture, arrow).

To bleed these versions of pump, loosen this hexagon-socket-head cap screw. Operate starting motor until fuel escaping at this point is free of bubbles; then re-tighten hexagon-socket-head cap screw.



2. Horizontal installation

To bleed horizontally installed distributor-type pumps (see picture), it is necessary, as in the case of vertical installation, to loosen the hexagon screw (arrow) in the central screw plug of the hydraulic head, and to re-tighten it after the fuel escaping is free of bubbles.



In various versions of pump, the bleeder screw is positioned on the side of the pump housing, see picture. (Distributor-type pump is shown horizontal for better clarity).

To bleed these distributor-type pumps, loosen the hexagon screw (arrow) shown in the picture. Operate starting motor until fuel escaping at this point is free of bubbles; then re-tighten bleeder screw.

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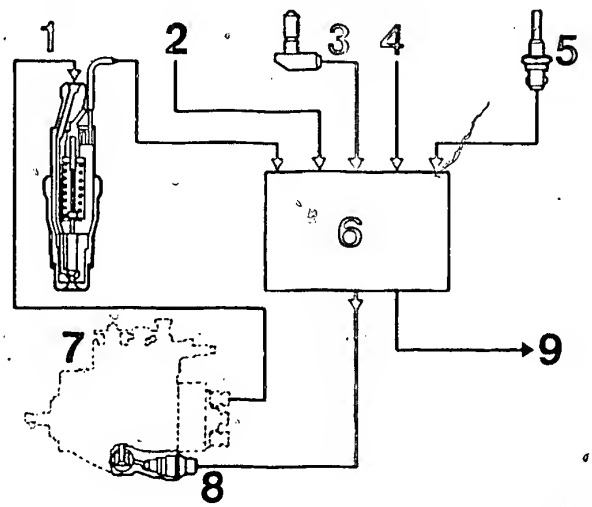
NEW SYSTEM

ELECTRONIC CLOSED-LOOP START-OF-INJECTION CONTROL ON DIESEL ENGINES WITH DISTRIBUTOR-TYPE INJECTION PUMP

Register tab 7 Systems

File Identity VDT-I-KFZ / 4 En

02.1986



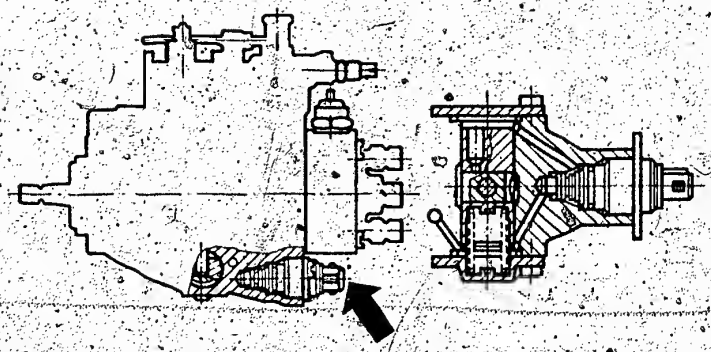
1 = Needle-lift sensor for start-of-injection measurement
2 = Load-dependent signal
3 = Engine-speed and TDC sensor
4 = Altitude-dependent signal
5 = Water-temperature sensor
6 = Control unit
7 = Fuel-injection pump
8 = Solenoid-operated valve
9 = Fault message (diagnosis)

System diagram of electronic closed-loop start-of-injection control

The start of injection is one of the main influencing parameters regarding the operating performance and combustion in the diesel engine. Starting, noise, fuel consumption and emissions are decisively influenced by the start of injection.

To comply with emission limits, fuel consumption and optimized comfort, it is necessary to have fuel-injection systems that guarantee high flexibility of governing as well as the possibility of processing additional parameters with small tolerances and high accuracy, throughout the service life.

These requirements are met by the electronic closed-loop start-of-injection control system. Compared with mechanical systems, electronic measuring, data processing and the closed loop with electrical actuator (solenoid-operated valve) result in improved and new governing functions.



460/1208

The basic construction and operating principle of the distributor-type injection pump with electrically energized timing device are the same as in the mechanically governed injection pump.

The quantity of fuel injected is controlled by a mechanical centrifugal-force governor.

The solenoid-operated valve is installed in a protected location on the underside of the injection pump (arrow) without considerably changing the outer contours of the injection pump in the area of the timing device.

The electronic closed-loop start-of-injection control system can be broken down into three central blocks:

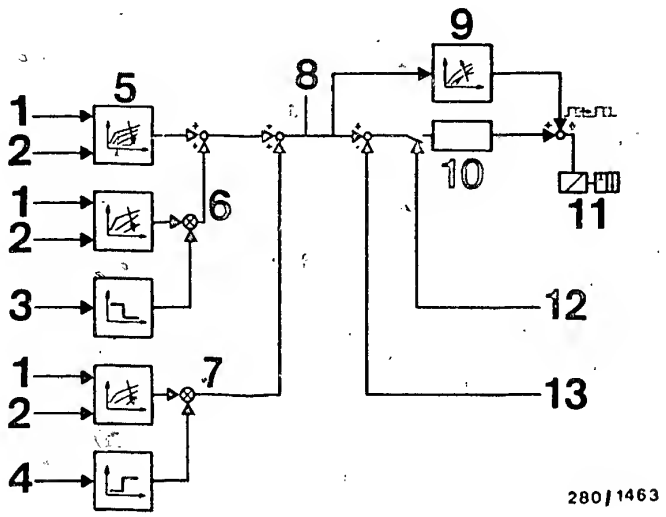
* Sensors (e.g. needle-lift sensor, engine-speed/TDC sensor and water-temperature sensor)
  The sensors detect the operating conditions and convert the physical quantities into electrical signals.
* Control unit with microprocessor
  The control unit processes the information in accordance with a preset internal evaluation system and supplies electrical output signals.
* Actuator (solenoid-operated valve)
  The actuator converts the electrical output signals from the control unit into mechanical quantities.

Sensors

The start of injection is detected by a sensor which is integrated into the nozzle holder and which tells when fuel is injected by detecting the needle lift.

A common engine-speed sensor is used for measuring the engine speed and for detecting top dead center (TDC) or a reference signal.
This sensor detects marks which are attached to the crankshaft flywheel in addition to the starting-motor ring gear according to the number of engine cylinders.

The air pressure and coolant temperature are measured by sensors which are characterized by a high measuring accuracy and long-term stability.



Block diagram of electronic closed-loop start-of-injection control,

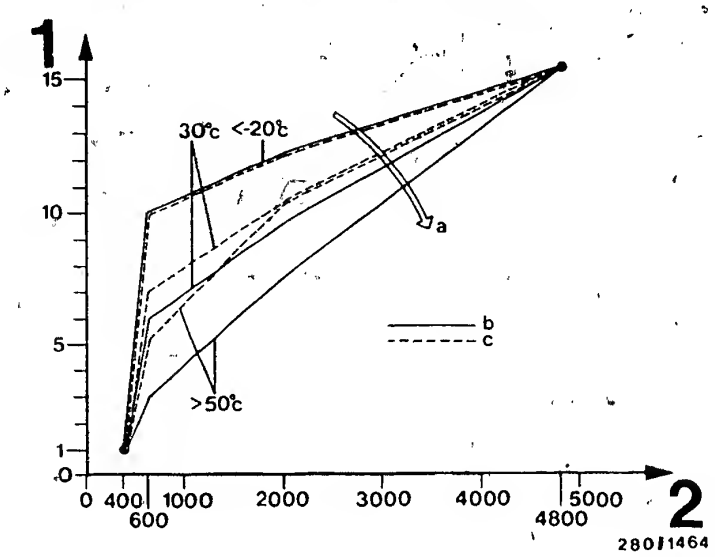
1 = Engine-speed signal
2 = Temperature signal
3 = Atmospheric pressure
4 = Engine torque
5 = Maps
6 = Altitude compensation
7 = Load correction
8 = Optimized start of injection
9 = Preset map
10 = PI controller
11 = Solenoid-operated valve
12 = Switched by control unit
13 = Actual start of injection

Control unit

The electronic control unit is of digital design. The microprocessor contains memory units (maps) with start-of-injection setpoints as a function of:

* Load
* Engine speed
* Coolant temperature
* Altitude

The circuitry is completed by devices for converting the sensor signals into computer-compatible quantities.



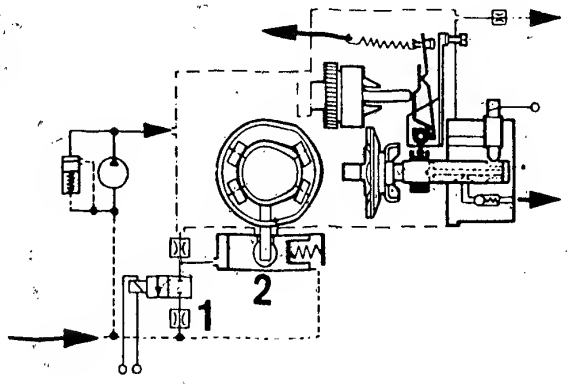
Start-of-injection map, parameters of engine load and coolant temperature

1 = Start of injection in °crankshaft before TDC
2 = Engine speed (min^{-1})

a = Water temperature
b = No-load
c = Full load

Note:

The graph shows an example of a load-dependent start-of-injection map for various coolant temperatures.

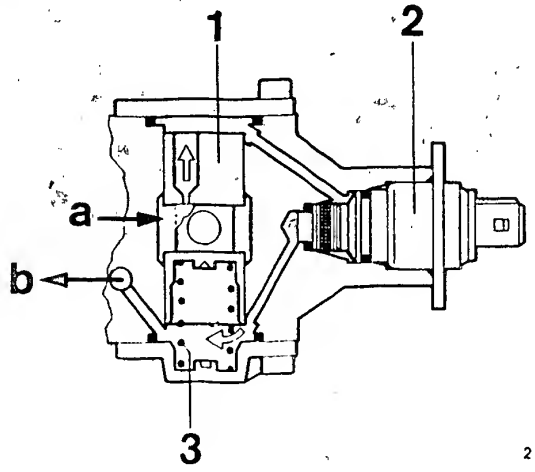


280/1465

1 = Solenoid-op. valve 2 = Timing device
Distributor-type injection pump with electronically energized timing device.

Governing

Thanks to the closed control loop, the actual start of injection, which is measured directly at the injection nozzle, is compared with the programmed start-of-injection setpoint in the control unit.
If there is any deviation, the solenoid-operated valve on the timing device is energized. The on/off ratio is changed until the deviation is zero.
Through this pulsing of the solenoid-operated valve, the actuating pressure at the timing-device piston is modulated and is superimposed on the basic mechanical timing.
This ensures the same dynamic performance as with mechanical start-of-injection timing and also guarantees operation. should the electronics fail.



1 = Timing-device piston
2 = Solenoid-operated valve
3 = Timing-device spring

a = Pump interior pressure
b = Pump inlet pressure (= Supply-pump intake pressure)

Solenoid-operated valve

The rpm-proportional pump interior pressure is applied to the timing-device piston.

With the solenoid-operated valve permanently open (pressure reduction), there are late starts of injection; with the valve fully closed (pressure increase) there are early starts of injection. Between these extremes the on/off ratio (ratio of open time to closed time of the solenoid-operated valve) can be constantly varied by the control unit.

Limp-home functions

Should the needle-lift sensor fail, there is a switch from closed-loop to open-loop mode.

If the engine-speed sensor fails, a substitute engine-speed signal is established from the time interval between the start-of-injection signals from the needle-lift sensor.

If both sensors fail, fixed input data are specified for the maps.

Service

To provide rapid detection of malfunctions, the control unit is equipped with a self-diagnosis feature, with which defective components are identified by a fixed flashing code.

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NEW SYSTEM | Register tab 7 | Systems

ELECTR.-CONTROLLED DIESEL | File Identity VDT-I-KFZ / 6 En

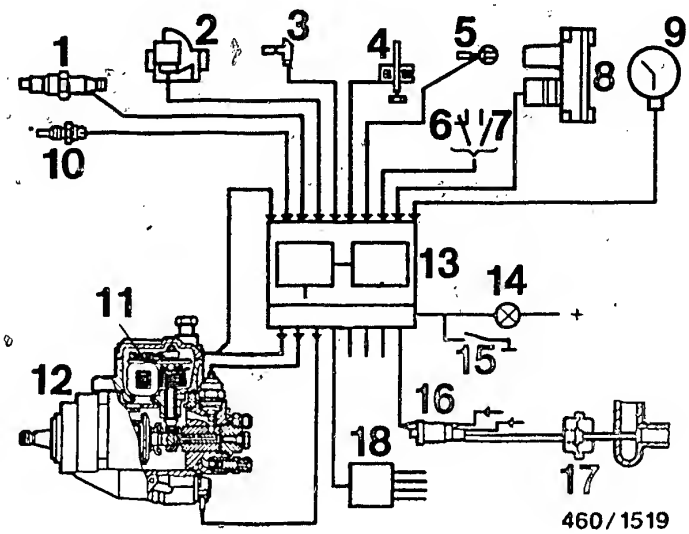
FUEL INJECTION WITH DISTRIBUTOR | 06.1986

FUEL-INJECTION PUMP

For several years, the requirements placed on diesel-fuel-injection systems with regard to emissions, fuel consumption, and comfort have been steadily rising. This necessitates systems having high flexibility of control, as well as providing the possibility of processing additional actuating variables with low tolerances and high exactitude, throughout their service lives.

These requirements are fulfilled by fully-electronically-controlled diesel fuel injection (EDC = Electronic Diesel Control). As compared with mechanical systems, electronic measurement, data processing, and the closed control loop using electrical and electro-pneumatic actuators provide new control functions and improve existing ones.

| | SERVICE INFORMATION | ==> |



1 = Nozzle holder with needle-motion sensor
2 = Air-flow sensor with air-temperature sensor
3 = Engine-speed reference-mark sensor
4 = Speed sensor
5 = Cruise-control operating lever
6 = Clutch switch
7 = Brake switch
8 = Manifold/atmospheric-pressure sensor
9 = Accelerator-pedal sensor
10 = Water-temperature sensor
11 = Fuel-temperature sensor
12 = Fuel-injection plug
13 = Control unit
14 = Diagnostic display
15 = Blink-code request button
16 = Electro-pneumatic pressure transducer or control valve
17 = EGR valve
18 = Glow-time control unit

Components of the electronic diesel fuel-injection system.

SERVICE INFORMATION ⇐=⇒

Improved and New Functions

Improvements:

Key start/stop
Choice of torque characteristic
Performance characteristic,
Load-independent idle speed
Cold-start acceleration
Smoke limitation
Pre-heating system control
Tamper proof
Exhaust-gas recirculation control
Cruise control

New functions:

Maximum engine speed limitation
Temperature-dependent full-load delivery
Temperature-dependent starting fuel delivery
Start-of-injection control
Active anti-bucking
"Electronic accelerator pedal"
(no mechanical linkage)

Possible outputs:
- Injection quantity signal
- Engine-speed signal
- Diagnosis

Limited adaptation through software alteration, reduced number of injection-comp variants resulting in reduced stocking.

Electronic diesel fuel injection is divided into three central system blocks:

* Sensors
  (e.g. needle-motion sensor, engine-speed reference-mark sensor, water-temperature sensor, etc.)
  The sensors determine operating conditions and convert physical values into electrical signals.

* Control unit with microprocessor
  The EDC system works with two control units. These control units process the sensor data according to certain internal evaluation criteria and generate electrical output signals.

* Actuators
  The actuators convert the electrical output signals from the control unit into mechanical quantities.

Sensors

Accelerator-pedal position, injection-pump control-rod position, and air flow are determined by potentiometers, and engine speed and start of injection by inductive pickups.

Resistance sensors measure pressure and temperature, and are noted for their extreme accuracy and long-term consistency.

Start of injection is determined by a sensor integrated in the nozzle holder which determines the moment of fuel injection by recognising needle motion.
A common engine-speed sensor is used to determine engine speed and to register a reference signal.
This sensor recognises marks made on the crank shaft fly wheel in addition to the starting-motor ring gear.
These marks correspond to the number of engine cylinders.

Control unit

The electronic control units are constructed using digital technology. They contain microprocessors, memory units (characteristic maps/characteristic curves) with nominal values depending on:

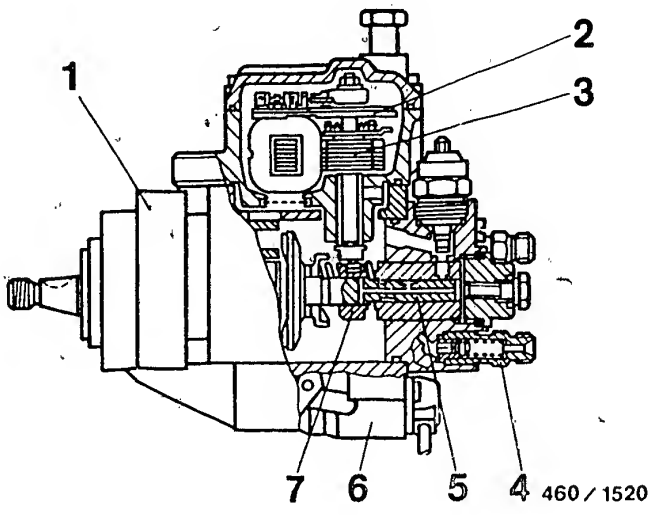
* Engine speed
* Temperatures
* Fuel delivery

Devices for the conversion of sensor signals into computer-standard values complete the circuitry.

Actuators

Separate actuators are required for injection quantity, start of injection, and exhaust-gas recirculation. The actuators for injection quantity and start of injection are integrated in the injection pump.
A rotary-magnet actuator directly affects the mechanical control of injected fuel quantity (control spool) via a shaft. The rotary motion is converted into a linear motion on the part of the control spool via an eccentrically-arranged driving pin. The control spool opens the cutoff cross sections depending on position, just as with the mechanically-controlled pump.

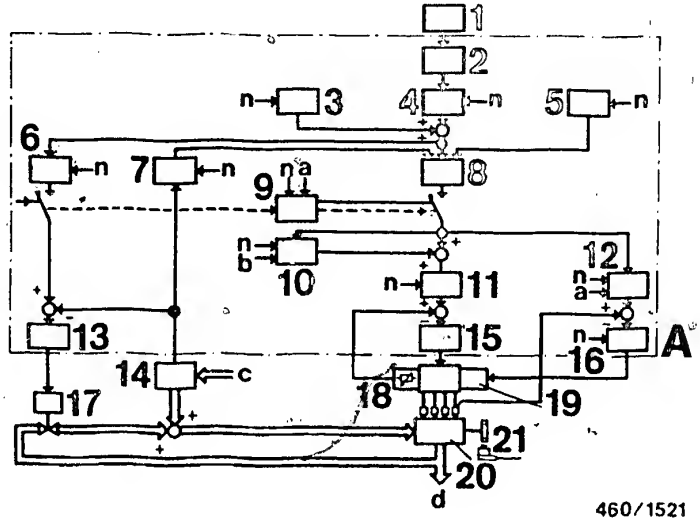
For actuation of start of injection, the pressure at the timing-device piston is modulated via a clocked solenoid-operated valve. When the solenoid valve is continuously open (pressure reduction), injection starts are late, while a fully-closed valve (pressure increase) results in early injection starts. The on-off ratio (ratio of opened to closed time of the solenoid-operated valve) can be continuously varied between these extremes by the control unit.



1 = Distributor-type fuel-injection pump for electronically-controlled diesel fuel injection
2 = Control-spool travel sensor
3 = Actuator for injection quantity
4 = Delivery-valve holder
5 = Supply plunger
6 = Solenoid-operated valve for start of injection
7 = Control spool

The exhaust-gas recirculation actuator (electro-pneumatic pressure transducer or control valve) is triggered with current impulses of differing lengths via the EGR regulator (in the control unit). The actuator thereby modulates the vacuum pressure present and triggers the EGR valve, resulting in an adaptation of the rate of exhaust-gas recirculation to the fuel-delivery quantity and engine speed.

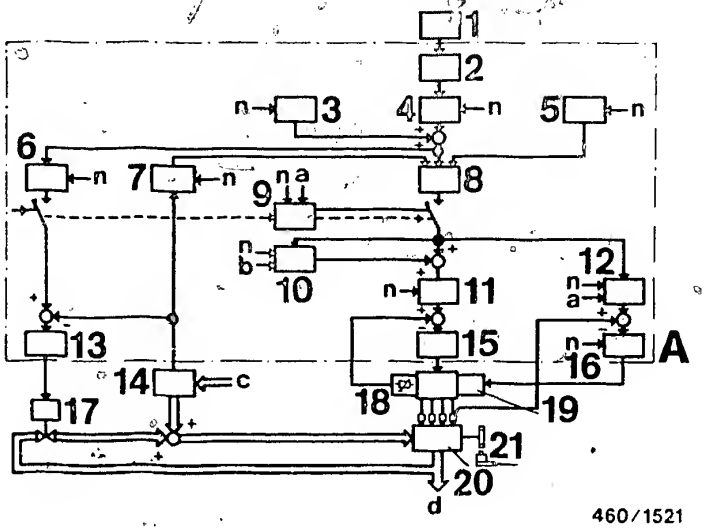
When using open-loop-controlled exhaust-gas recirculation without feedback from the air-flow sensor, the EDC triggers the EGR valve depending on injected fuel quantity and engine speed.



460/1521

1 = Accelerator pedal
2 = Rise limitation
3 = Lower-idle-speed control
4 = Accelerator-pedal characteristic map
5 = Full-load characteristic curve
6 = EGR characteristic map
7 = Smoke characteristic map
8 = Lowest-value selection
9 = Starting control
10 = Fuel-temperature correction
11 = Pump characteristic map
a = Engine temperature
b = Fuel temperature
c = Air
d = Exhaust
n = Engine speed
A = Contents of control units 1 and 2
Control unit 1 = Fuel-delivery and cruise control
Control unit 2 = Start of injection and exhaust-gas recirculation control, and diagnostic output.

Block diagram of electronic diesel fuel-injection control



460/1521

12 = Start-of-injection characteristic map
13 = EGR control
14 = Air-flow sensor
15 = Actuation regulator
16 = Start-of-injection regulator
17 = EGR actuator
18 = Pump with feedback
19 = Timing device
20 = Engine
21 = Engine-speed/reference-mark sensor
a = Engine temperature
b = Fuel temperature
c = Air
d = Exhaust
n = Engine speed
A = Contents of control units 1 and 2
Control unit 1 = Fuel delivery and cruise control
Control unit 2 = Start of injection and exhaust-gas recirculation control, and diagnostic output.

Block diagram of electronic diesel fuel-injection control (continued)

Closed-loop injection-quantity control

Starting, idle, performance, and soot emission are definitively influenced by the fuel-injection quantity. Consequently, a temperature-dependent starting-quantity characteristic map, low-idle-speed control, a performance characteristic map, and an air-flow-dependent full-load characteristic curve are programmed in.

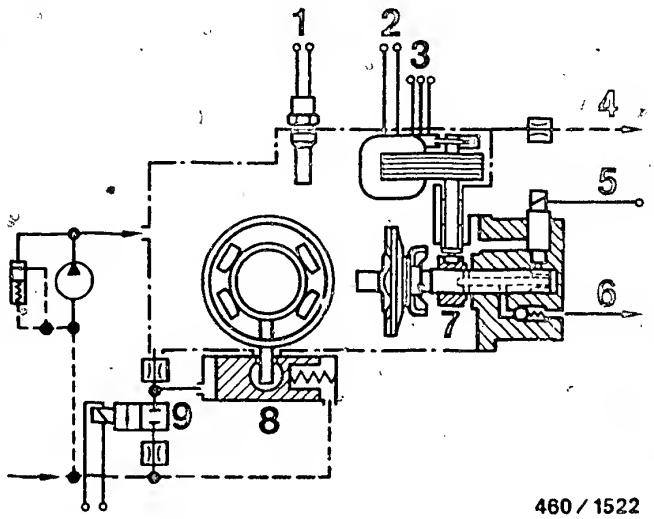
The driver's desired torque is specified via an accelerator sensor. In the control unit, a specified value for the position of the injection-quantity actuator is determined based on a certain control response and under consideration of the map values stored in memory. A closed actuation loop with feedback to the pump monitors the correct setting of the control spool of the injection pump.

Closed-loop start-of-injection control

Starting, noise levels, fuel consumption, and emissions are definitively influenced by start of injection.

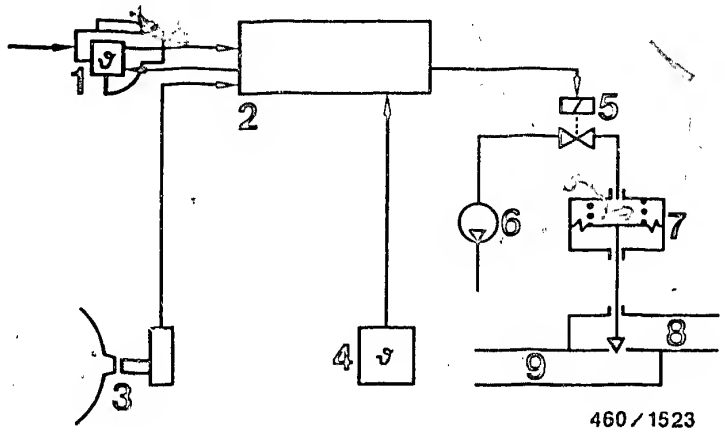
A characteristic start-of-injection map is programmed in which takes into account these dependencies. The extreme accuracy of start of injection is guaranteed by a closed control loop. For this purpose, the actual start of delivery is determined directly at the nozzle with a needle-motion sensor and compared with the programmed nominal start of injection. Any deviation results in an actuation of the solenoid-operated valve at the timing device. The on-off ratio is altered until the control deviation = nil.

Actuation pressure at the timing-device piston is modulated via this clocked solenoid-operated valve.



1 = Fuel-temperature sensor
2 = Fuel-delivery actuator
3 = Control-spool-travel sensor
4 = Overflow
5 = ELAB
6 = To injection nozzle
7 = Control spool
8 = Timing device
9 = Solenoid-operated valve

Schematic diagram of the distributor-type fuel-injection pump.



1 = Air-flow sensor with air-temperature sensor
2 = Control unit
3 = Engine-speed sensor
4 = Coolant-temperature sensor
5 = Exhaust-gas recirculation actuator
6 = Engine vacuum pump
7 = Exhaust-gas-recirculation valve
8 = Charge-air pipe
9 = Exhaust pipe

Block diagram of closed-loop-controlled exhaust-gas recirculation.

Exhaust-gas-recirculation closed-loop control

Exhaust-gas recirculation is used to reduce emissions. The exhaust-gas quantity inducted by the engine is indirectly controlled in a closed control loop via the determination of the outside-air-quantity in dependence on engine loading and engine speed. An EGR map is programmed into the control unit for this purpose. The actual value of outside air determined by an air-flow sensor is compared with the programmed nominal value. Any deviations are detected by a continuous regulator (built into the control unit).

This regulator actuates the electro-pneumatic pressure modulator (EGR actuator) until the corresponding setting of the EGR valve results in the correct exhaust-gas-recirculation quantity as indicated by the characteristic map.

Limp-home functions

The EDC system is self-monitoring. Computing functions as well as sensor operations are monitored. Upon malfunction on the part of sensors or components, appropriate safety or limp-home functions can be initiated.

Malfunction/limp-home measure

1. Delivery-quantity actuator defective:
   Engine is switched off via ELAB
2. Timing device defective:
   Fuel delivery is limited.
3. Air-flow sensor defective:
   Set value for air quantity, no exhaust-gas recirculation.
4. Exhaust-gas-recirculation actuator defective:
   Fuel delivery is limited and exhaust-gas recirculation switched off.
5. Accelerator-pedal sensor defective:
   Idle speed is increased.

Malfunction/limp-home measure

6. Engine-speed sensor defective:
Determination of a substitute engine speed from the start-of-injection signal.
Cruise control and exhaust-gas-recirculation control are switched off. Start of injection is open-loop controlled, injection quantity reduced, max. engine speed limited, and idle speed increased.
7. Needle-motion sensor defective:
Fuel delivery is limited and start of injection is open-loop controlled.
8. Road-speed sensor defective:
Cruise control is switched off.
9. Water-temperature sensor defective:
Control unit works with substitute values and exhaust-gas recirculation is switched off.
10. Air-temperature sensor defective:
Control unit works with substitute values and exhaust-gas recirculation is switched off.
11. Fuel-temperature sensor defective:
Control unit works with substitute values.
12. Actuating potentiometer defective:
Engine stops, delivery-quantity actuator is switched off.
13. Pressure modulator for cruise control defective:
Cruise control is switched off.
14. Charge-air/atmospheric-pressure sensor defective:
[redacted] altitude correction on part of exhaust-gas [redacted]circulation.
15. Computer linkage (control unit) defective:
Full-load delivery is reduced. Control unit works with substitute values.
16. Computer monitoring (control unit) defective:
Control unit 1 defective: delivery-quantity actuation is switched off.
Control unit 2 defective:
Start-of-delivery solenoid-operated valve without current, exhaust-gas recirculation is switched off.

Service - Self-diagnosis

A self-diagnosis system is integrated in the control unit for the early detection of malfunctions. Damaged components or current paths are identified by specific blink codes. For this purpose an indicator lamp can be mounted in the dash board, which then lights up in case of a malfunction. The diagnostic program can be activated by pressing a button.

The program then starts with a start code and ends with an end code. The blinking displayed between the start and end codes indicates the defective operation.

If more than one malfunctions are present at the same time they can be called one after the other. Recognized malfunctions are stored in memory and are not deleted even after the ignition is switched off.

Example of a blink-code setup:

1.1 Program-end code
1.2 Program-start code
1.3 Air-temperature sensor defective
1.4 Coolant-temperature sensor defective
1.5 Fuel-temperature sensor defective
2.1 Accelerator-pedal sensor defective
2.2 Actuator potentiometer defective
2.3 Fuel-delivery actuation defective
2.4 Road-speed sensor defective
2.5 Cruise-control pressure regulator defective
3.1 Charge-air/atmospheric-pressure sensor defective
3.3 Air-flow sensor defective
3.4 Exhaust-gas-recirculation actuator defective
4.1 Engine-speed sensor defective
4.2 Needle-motion sensor defective
4.3 Start-of-injection solenoid-operated valve defective

Example of application:

1.2 Program-start code = 1 blink pulse - pause (approx. 3 - 4 s) - 2 blink pulses.

Deleting blink code

Depending on the design of the diagnostic program, a fault stored in memory can be deleted by simultaneously pressing the brake or clutch pedal and diagnosis-initiator button.

Published by:

Robert Bosch GmbH
Division KH
After-Sales Service Departments
for Training and Technology (KH/VSK)

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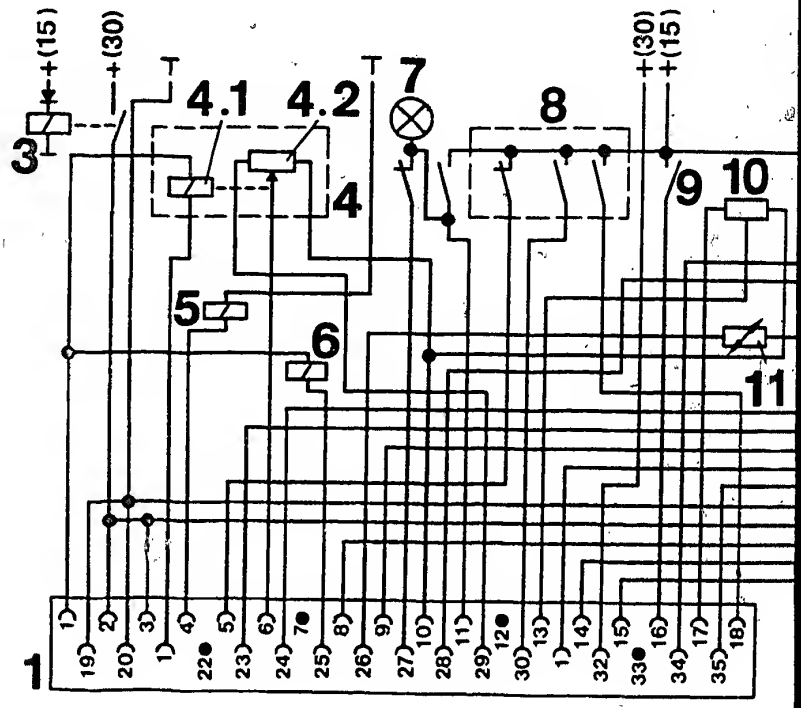
C2

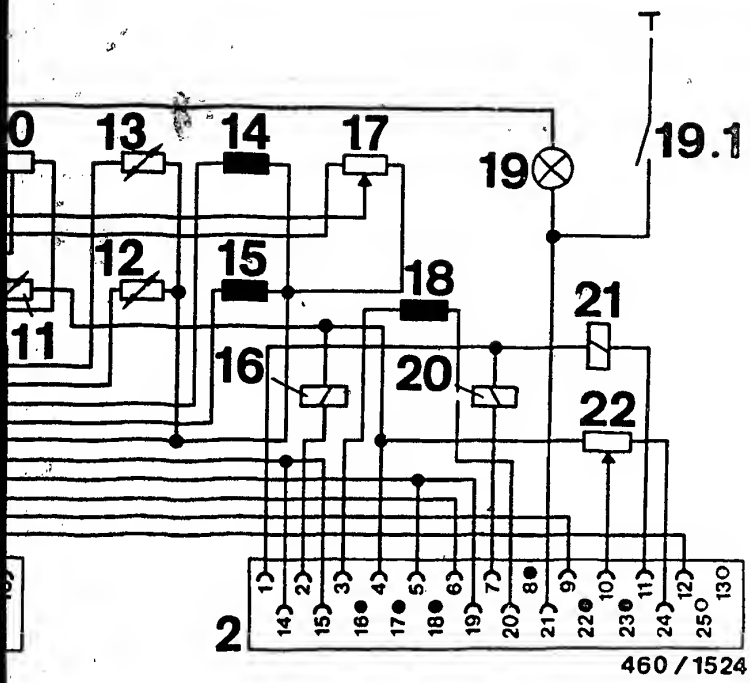


1. = Fuel-delivery control unit
2 = Exhaust-gas-recirculation/start-of-injection control unit
3 = Reversed-polarity protection relay
4 = Fuel-injection pump
4.1 = Fuel-delivery actuator
4.2 = Actuation potentiometer
5 = ELAB
6 = Pressure modulator *

7 = Stop lamps
8 = Cruise-control ope
9 = Air conditioner
10 = Accelerator-pedal
11 = Air-temperature se
12 = Water-temperature
13 = Fuel-temperature s
14 = Road-speed sensor
15 = Engine-speed senso
16 = Timing device

ELECTRICAL TERMINAL DIAGRAM OF AN ELECTRONICALLY-CONTROLLED DIESEL-FU

| | SERVICE INFORMATION | <===> |



operating lever
er
dal sensor
e sensor
ure sensor
ure sensor
sor
ensor

17 = Charge-air/atmospheric-pressure sensor
18 = Needle-motion sensor
19 = Diagnostic display
19.1 = Diagnosis request
20 = EGR valve
21 = Gear-shift valve *
22 = Air-flow sensor

* = only on vehicles equipped with automic transmission

L-FUEL-SYSTEM

New product

0 335 550 201 – Electronic battery tester

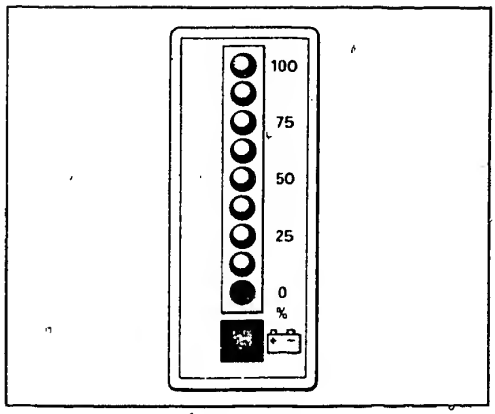
VDT-I-335/4 En
1. 1979

1. Application

Batteries are installed in
Caravans
Camping vans
Boats
Electric vehicles
Outboard engines

for the powering of auxiliary equipment, or equipment stipulated by law, such as auxiliary lamps, position lights etc. In such cases, insufficient battery charge (capacity) only becomes evident when the loads no longer deliver sufficient power.

In order to prevent exhaustive discharge and the resulting premature destruction of the battery, Bosch has introduced a battery tester onto the market. The tester is connected to the battery and can replace the conventional residual-capacity test carried out by the customer using a hydrometer



2. Operation

With lead-acid batteries (accumulators), there exists a relationship between the voltage at the terminals and the battery residual capacity. This relationship is evaluated by the electronic battery tester

The tester is designed for a nominal voltage of 12 V.

When the test knob is pressed, linear indication of the residual capacity of the battery is indicated by light-emitting diodes (LED). Indication is from 0% to 100%. The green LED's indicate the OK-state. The red LED's indicate that further discharge of the battery will result in its service life being considerably reduced.

During the test, a load is to be switched on which must be appropriate to the rating of the battery (further details are to be taken from the Operating Instructions for the battery tester)

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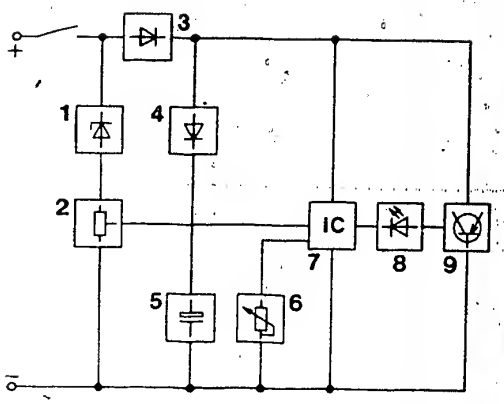
C5

E7 C5

3. Function

As can be seen from the block diagram, the circuitry is composed of 9 component groups. In the first group, the input voltage is stabilized to a particular voltage. The residual voltage is fed to the IC (7) by way of the voltage stabilizer (2). Component groups (2) and (6) are the input-voltage stabilizers for the integrated circuit (7). In component groups (3) and (4) the diodes have a protective function against voltage peaks, as does the capacitor in component group (5). Depending upon the magnitude of the input voltage, the IC (7) passes a defined voltage to the LED-group (8). One of the nine LED's now lights up in accordance with the voltage level. The transistor in component group (9) serves te ensure a reliable OK-state display.



1 = Voltage stabilization
2 = Voltage divider
3 = Protective diode
4 = Protective diode
5 = Capacitor
6 = Voltage divider
7 = Integrated circuit (IC)
8 = LED-group
9 = Transistor

0 30..
Detachment of Lens in Auxiliary and Main Headlights

VDT-BME 610/8 B LE 30
< VDT-I-300/100 B >
Edition 3.1975
Translation of German edition of 20.1.1975

Destroy edition of 3.1972!

When the lenses of auxiliary and main headlights are stuck to the reflector or rim, it may happen that the lens comes away.

When such a complaint is made, the customer receives a free replacement in the form of a headlight unit consisting of lens and reflector or lens and rim.

Warranty period and action required

When definitely established that the adhesive is at fault, report this to us under fault number 62. Please add this fault number in handwriting to Fault Number List VDT-WAA 050/9-06 B.

In fairness we rectify such faults as occur outside the warranty period without charge. In this case enter a "7" under column 59 or GA (form of warranty).

In case of inquiry, please contact your authorized representative.

ROBERT BOSCH GMBH
Geschäftsbereich KH
Kundendienst - Technik

BOSCH Geschäftsbereich KH Kundendienst
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C7

B2

C7

0 30..Complaints regarding Halogen Auxiliary Lamps

VDT-I-300/101 B
3.1976

Complaints continue to be received about halogen auxiliary headlamps which can be attributed to the following causes:

1. Shattered lens

Tests have shown that this damage only occurs due to outside influences and only when the lens is hot, i.e. when the lamp is switched on or was in use shortly beforehand. With the lamp switched on, and the vehicle stationary, the lens quickly heats up to approx. 120°C (250°F) due to the shallow design of the lamp, and bursts if it is cleaned with a wet cloth or sponge. In order to avoid this type of damage, the following should be noted:

Hot lenses should only be cleaned with an absolutely dry cloth.

If it is necessary to clean the lens with a wet cloth or sponge, they must be allowed to cool down until only slightly warm.

The Bosch-Service Travellers must, above all, pass this information on to the filling stations; experience has shown namely that this is where a particularly large number of vehicles are washed and headlamps cleaned.

1.1 Warranty

We refuse to recognise the warranty claim, even inside the warranty period, if the lens has been mishandled.

1.2 Lens replacement

For technical reasons concerned with production, it is only possible to replace lenses together with their reflector. The Part Number on the lens itself is not the number for the combined lens and reflector. When ordering, therefore, use the Part Numbers given in the Service Part Microfiche EE..

2. Misting over of lenses

We must differentiate between the 2 causes. Either the lamp leaks, or condensation forms on the inside of the lens.

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If the lamp leaks, this is due either to faulty assembly or to it being mounted incorrectly. In this regard, particular attention must be paid to the lamp being mounted the right way round, that is, a lamp for upright mounting must not be mounted as though it were a pendant-mounting lamp and vice-versa. If this has happened then the water-drainage hole, which should point downwards, points upwards and allows water to enter which cannot drain out.

Formation of condensation water on the inside of the lens is caused by the difference between the temperature inside the headlamp and that prevailing outside. It is not evidence that the lamp leaks. The condensation water disappears shortly after the lamp is switched on, and has no negative effects on the reflector or on the funtion of the lamp as a whole.

2.1 Warranty

We refuse to recognise the warranty claim, even inside the warranty period, if the customer complains about condensation water farming an the inside of the lens of halogen auxiliary lamps.

In case af inquiry, please contact your authorized representative.

New Product

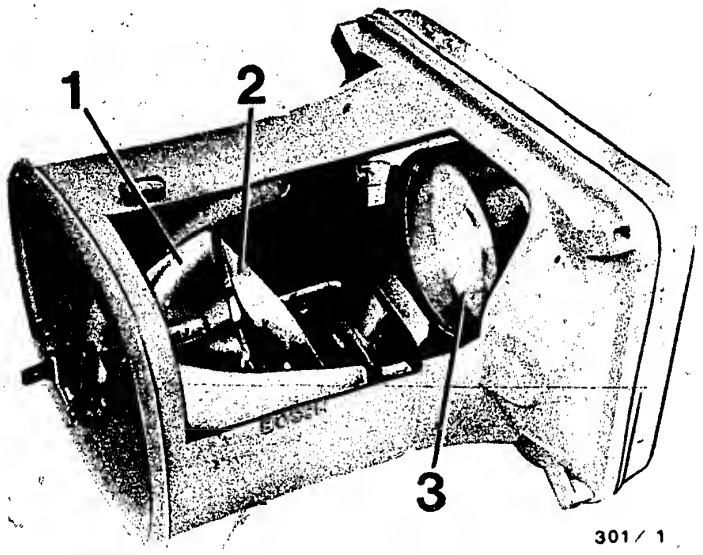
Register 13...39

File Identity VDT-I-301/1 En

PES HEADLAMPS

Lower-beam headlamp with polyelliptic system

7. 1986

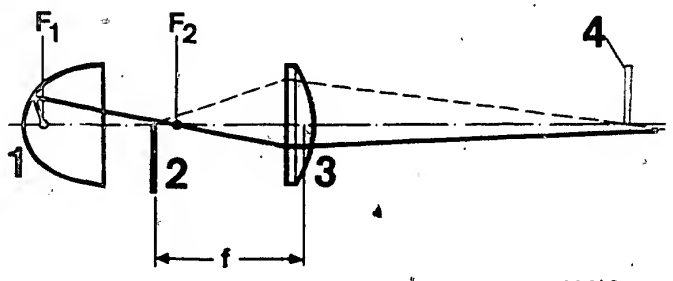


301/1

1 = Reflector
2 = Screen
3 = Objective

The PES headlamp has been developed for installation in future vehicles with a low-profile front section (low drag coefficient) and for improved illumination of the roadway.

PES Headlamps ===►



301/2

1 = Reflector
2 = Screen
3 = Objective
4 = Image of screen

F_1 = Focal point 1
F_2 = Focal point 2

f = Focal length of objective

Operating principle

Basically, the PES headlamp functions in the same manner as a slide projector.
Essential to both is the imaging of an object via an objective, the object in the case of the slide projector consisting of the slide, whereas, in the case of the PES headlamp, it consists of the screen (2).
The image of the screen edge (4) forms the cutoff.

Advantages of PES lower-beam headlamp:

* Small installation dimensions (60 mm diameter of rim aperture)

* Improved and more uniform illumination of the roadway, since the objective provides accurate light distribution on the roadway

* Improved lateral illumination of the roadway.

The PES headlamp is being installed for the first time in Neoplan buses made by Auwärter.

Published by:

Robert Bosch GmbH
Division KH
After-Sales Service Department
for Training and Technology (KH/VSK)

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Halogen supplementary lamps with glued lens

LE
VDT-BME 612/8 B 30
< VDT-I-305/100 B >
Edition 9.1974
Translation of German edition of 16.8.1974

Destroy edition of 4.3.1974

In most halogen headlamps the lens and reflector are now inseparably joined with thermoplastic adhesive to form a unit. Therefore, in case of damage, neither the reflector nor the lens can be replaced separately. For this reason, a service part unit, comprising reflector and lens, is given in the Service Parts List.

As the part number stamped on the lens is often mistaken for the unit part number, a cross-reference chart is listed below.

In case of inquiry, please contact your authorized representative.

ROBERT BOSCH GMBH
Geschäftsbereich K-Ausrüstung
Handel
Kundendienst-Technik

Headlamp	Lens	Light Unit	Color
0 305 001 001	1 305 620 329	1 305 320 816	achromatic
002	330	817	yellow
003	329	820	achromatic
0 305 250 001, 003	1 305 620 020	1 305 320 091	achromatic
002, 004	021	092	yellow
005	020	925	achromatic
006	021	926	yellow
0 305 251 001, 003	1 305 620 020	1 305 320 091	achromatic
002, 004	021	092	yellow
005	020	925	achromatic
006	021	926	yellow
0 305 253 001, 003	1 305 620 025	1 305 540 906	achromatic
002, 004	025	907	"
005	025	910	"
006	025	911	"
007	029	912	"
008	029	913	"

BOSCH
Geschäftsbereich KH Kundendienst

Headlamp	Lens	Light Unit	Color
0 305 255 006, 008, 010, 012, 014 007, 009, 011, 013	1 305 601 028 029	2 305 301 901 902	achromatic yellow
0 305 451 001, 003, 005, 007 002, 004, 006, 008 009, 011 010	1 305 602 035 036 2 305 602 001 002	1 305 303 908 912 2 305 303 904 905	achromatic yellow yellow achromatic
0 305 553 007, 009 008, 010	1 305 602 025 026	2 305 303 901 902	achromatic yellow
0 305 554 001, 003, 005, 007 002, 004, 006, 008	1 305 620 086 087	1 305 320 951 952	achromatic yellow
0 305 600 001, 004 002, 005 003, 006	1 305 620 313 314 319	1 305 320 807 808 304	achromatic yellow achromatic
0 305 650 001, 003, 005, 008 002, 004	2 305 601 001 002	2 305 311 005 006	achromatic yellow
0 305 651 001, 003, 005 002, 004	2 305 603 001 002	2 305 302 908 909	achromatic yellow
0 305 750 001, 003, 007 002, 004	1 305 620 108 109	1 305 620 901 902	achromatic yellow
0 305 850 001, 003 002, 004	2 305 620 005 006	2 305 320 904 905	achromatic yellow
0 305 851 001, 003 002, 004	2 305 620 007 008	2 305 320 912 913	achromatic yellow
0 305 900 001, 003 002, 004	1 305 603 031 032	1 305 313 930 931	achromatic yellow
0 305 950 001, 002 003	3 305 604 002 1 305 604 016	3 305 304 013 1 305 304 901	achromatic yellow
0 306 001 001 002 003	1 305 620 331 332 331	1 305 320 818 819 821	achromatic yellow achromatic
0 306 304 005 006, 007, 008	1 305 601 013 014	2 305 301 906 905	achromatic yellow
0 306 305 003, 004, 006 007, 009, 012	1 305 601 006 045	2 305 301 903 904	achromatic "
0 306 401 001, 002, 007, 008, 011 003, 004, 009 005, 006 010, 012	1 305 602 037 038 039 027	1 305 303 909 910 911 913	achromatic yellow achromatic yellow
0 306 504 003, 004 005	1 305 602 028 045	2 305 303 903 302 901	achromatic "
0 306 505 001, 002, 007 003, 004 005, 006 008	1 305 620 088 090 089 084	1 305 320 953 954 955 961	achromatic yellow achromatic yellow

Headlamp	Lens	Light Unit	Color
0 306 600 001	3 305 603 006	3 305 303 016	achromatic
002	1 305 603 030	1 305 303 102	yellow
0 306 601 001, 003, 005	2 305 601 003	2 305 311 012	achromatic
002, 004	004	013	yellow
0 306 602 001, 003	2 305 603 003	2 305 302 910	achromatic
002, 004	004	911	yellow
0 306 603 001, 003	1 305 620 315	1 305 320 809	achromatic
002, 004	316	810	yellow
0 306 700 001, 002	1 305 620 105	1 305 620 903	achromatic
003, 004	103	904	achromatic
005, 006	104	905	yellow
007	106	906	"
0 306 701 001	3 305 603 007	-	achromatic
002	009	-	green
003	008	-	red
004	010	-	yellow
0 306 800 001	3 305 604 001	3 305 304 012	achromatic
0 306 801 001, 003	2 305 620 003	2 305 320 906	achromatic
002, 004	004	907	yellow
0 306 802 001, 003	2 305 620 009	2 305 320 914	achromatic
002, 004	010	915	yellow
0 306 900 001	3 305 604 001	3 305 304 012	achromatic
002, 003	007	001	"
004	1 305 604 015	1 305 304 900	yellow
0 306 901 001, 003	1 305 603 033	1 305 313 932	achromatic
002, 004	034	933	yellow

C15

General instructions regarding the interference-suppression in motor vehicles

VDT-I-Gen. 011 En
8. 1978

Table of contents

1. Notes

Inductive semiconductor ignition (TCI) and capacitor-discharge ignition (CDI) systems
The installation and wire-routing specifications of the original equipment manufacturer are a prerequisite for the proper operation of breaker-triggered and breakerless ignition systems.

Breaker-triggered TCI and CDI systems
The high-tension circuit is provided with interference suppression in the same manner as with inductive ignition. A 0.2 µF suppression capacitor can be connected in parallel with the distributor contact points as an auxiliary measure.

Breakerless TCI and CDI systems
In the case of **TCI** systems, no interference-suppression devices may be connected to terminal 16 of the trigger box, terminal 1 of the ignition coil or the control lead.
In the case of **CDI** systems, interference-suppression devices may not be connected to the two terminals of the ignition transformer nor to the control leads.
The high-tension circuit is provided with interference suppression in the same manner as with inductive ignition.

Inductive ignition
See instructions below.

2. General

When operating motor-vehicle electrical systems (e.g.: ignition system, alternator/generator) undesired high-frequency electromagnetic waves occur which may impair the reception of the receiver built into the car in question in addition to that of radio receivers in other motor vehicles or that of radio and television receivers in the area. This high-frequency interference to radio reception is known as radio interference.
Such interference is audible in the loudspeaker as buzzing, clicking, background noise, bubbling or hissing or appears on the screen as strips, lines etc. impairing the desired reception or under certain circumstances making it impossible. Means must therefore be sought to eliminate this inter-

ference or to reduce it i.e. interference suppression must be provided for the devices and systems (so-called sources of interference) which cause radio interference. This is done using radio interference-suppression devices i.e. units comprising electrical or mechanical components or a combination of the two.

Interference can reach the receiver (e.g. radio) of the motor vehicle along various paths. Such interference is normally passed to the receiver via the aerial, frequently also via the battery cables (power supply) and occasionally via the loudspeaker cables.

Trouble-shooting should always commence with a check of the aerial and its installation. Proper car radio reception depends on three factors connected with the receiving aerial:
Installation position,
Vehicle ground,
Continuity.

3. Interference-suppression categories

Long-distance interference suppression
Long-distance interference suppression is required by law for all motor vehicles. Such interference suppression is fitted at the vehicle manufacturer's factory.

The aim behind long-distance interference suppression is to prevent interference generated in the motor vehicle from being transmitted to television and radios as well as transmitters and receivers outside the vehicle.

Short-distance interference suppression
Short-distance interference suppression in the motor vehicle is necessary if a radio, television or portable radiotelephone (particulary CB radio) is installed. The demands made upon interference suppression and the degree of technical sophistication required are greater with short-distance interference suppression than with long-distance interference suppression and differ from vehicle type to vehicle type as well as from vehicle to vehicle.

4. Interference-suppression devices

Resistors
Spark-plug connectors, distributor caps and distributor rotors with built-in interference-supression resistor, suppressed spark plugs

Capacitors and chokes
Shunt capacitors, chokes, feed-through capacitors, bypass capacitors and interference-suppression filters.

Screening
Screened spark-plug connectors, screened ignition cables, screened distributor caps

Ground
Grounding straps, grounding springs, conductive V-belts

5. Interference suppression with CB radio

A prerequisite for special CB radio interference suppression is thorough interference suppression for all wavebands. If good reception is not achieved in this manner further measures must be taken.

- Installation of an aerial for **CB radio** (centre of roof or centre of luggage compartment lid).
- Ensure good electrical matching between aerial and car radio.
- Grounding straps from the hood and luggage-compartment lid to the vehicle body.

If, despite such interference-suppression measures, ignition interference is still present or if the alternator howls in the loudspeaker, additional measures must be taken.

- Shield distributor and high-tension lead between ignition coil and distributor (metal-covered distributor cap, screened ignition cables).
- Fit alternator with interference suppression (with dual-circuit filter 0 290 002 044, in the case of separately-fitted regulator. Provide connecting cables between regulator and generator/alternator with interference-suppression braiding).
- Partially-screened/fully-screened systems.

6. Sources of interference

The following sources of interference are possible in the electrical system of a motor vehicle:

- Ignition systems (ignition spark, distributor and contact breaker sparks)
- Generator/alternator and regulator (brush arcing and contact sparks)
- Electric motors, e.g. wiper motor, blower motor, electric fuel pump (brush arcing)
- All switching contacts during make and break, turn-signal flashers, relays
- Electric horns or fanfare-horn sets (contact breaker)
- Loose contacts in conductors through which current flows, loose chassis connection of aerial, loose contacts in ignition cables
- Electrostatic charging and discharging of tyres, generator/alternator V-belts or from parts of the transmission system, Bowden cables (e.g. for heating, hood catches) and exhaust system
- Interference may also be caused by poor or varying contact between metal parts of the motor vehicle

Of the sources of interference listed above ignition interference is the most severe.

The interferece caused by turn-signal systems, horns and relays can only be suppressed at great expense and should therefore be dispensed with especially since the sound of the blinker in the loudspeaker may be desired as a check

Certain types of interference cannot be eliminated:

Heterodyne:	Reception of 2 stations at the same time
Fading:	Fluctuations in the strength of the signal received
Multipath reception:	Fading or no reception whatsoever (cancellation of signal)
Shadow effect (VHF):	Interference due to obstacles, i.e. attenuation of the transmission signal
Reflection (VHF):	Greater or lesser degree of radiation of signal from buildings, obstacles etc.
„Picket fence interference" (VHF):	Due to reflection

7. Identification of interference, notes on its elimination

7.1 Measures to improve interference suppression in the vicinity of the aerial

Installation of aerial
Since there is always a residual noise level in the immediate vicinity of the source of interference, despite optimum interference suppression (e.g. ignition system), the receiving aerial must be mounted as far as possible from the source of interference. In the VHF range the best reception is obtained on the front window pillar provided the aerial rod is aligned as far as possible parallel to the pillar. In the case of motor vehicles with a front engine it must be ensured that the aerial is always mounted on the side opposite the ignition system, i.e. if the distributor, ignition coil and spark plugs are situated to the left of the engine in the direction of travel the aerial must be mounted to the right in the direction of travel on or in the wing or on the window pillar.
In the event of very severe interference the aerial is installed on the roof or rear of the vehicle.
It should be noted that if the aerial is installed on the roof or rear it should be in the vicinity of body edges for optimum radio reception.

Cleaning the aerial
Before any measurements are performed on the aerial it must first be cleaned (Bosch aerial cleaning cloth). Dirt reduces the useful signal output from the aerial i.e. radio reception is poorer.

Aerial ground contact
Aerial interference is largely dependent upon the aerial ground contact. The better the contact, the less the interference.

In the event of interference:
Check ground connection. Scrape and clean aerial mounting hole from below then grease with Bosch universal grease (order number 5 700 014 082)

The base of the aerial and the case of the radio must be at ground potential.

Aerial continuity
An exact check is made here using an ohmmeter. Measurements are made (low-resistance measuring range) from the aerial rod to the aerial connector. In order to detect any breaks the aerial and aerial cable should be moved during the measurement.

The resistance should ideally be 0 ohms, at most 3 ohms.
Aerials with a higher resistance are faulty and should be replaced.

7.2 Detection of path taken by interference

Interference via aerial
For rapid diagnosis the aerial connector is pulled from the car-radio aerial socket. In order to maintain the car radio at full gain an artificial aerial (65–90 pF capacitor) is inserted into the aerial socket of the car radio in place of the aerial connector.

If the interference reached the car radio via the aerial it should no longer be audible.
If it is established that the interference is coming via the aerial a check should be made as to whether the source of interference (ignition system, regulator, wiper etc.) is connected according to the interference-suppression instructions and whether the interference-suppression devices are connected to ground.

If interference occurs with electronic aerials the supply line is to be connected to an interference-suppression filter, e.g. 8 634 490 661 and/or a suppression capacitor, e.g. 0 290 800 022.

Interference via positive lead of battery
Interference reaching the car radio via the positive lead is normally of the low-frequency, non-radiating type. It is passed from the source of interference via the vehicle electrical system to the input of the car radio (e.g. alternator howling).
A typical feature of interference via the positive lead or loudspeaker cables is that the noise remains just as loud even if the volume control is turned down.
In such a case a connection point in the vehicle electrical system which is interference-free or the installation of an additional interference-suppression filter in the positive lead in the vicinity of the car radio provides a remedy.

Interference via loudspeaker cable
Interference reaching the car radio via the loudspeaker cable is normally of the low-frequency, non-radiating type (e.g. alternator howling). It is transmitted to the loudspeaker cable via the cables of the vehicle electrical system and reaches the car radio via the loudspeaker output.

Relocating the loudspeaker cable provides a remedy.
Under no circumstances should loudspeaker cables be routed in parallel with other cables or wiring harnesses nor should they be looped around

C18

C18 AT A5

cables or wiring harnesses for the sake of more rapid installation. The routing of the aerial cable should also be checked with the same aspects in mind.

Interference via connecting cable between radio and cassette recorder
No interference when radio in use: only when cassette recorder in use.

Relocation of these connecting cables provides a remedy. If applicable, check cassette on another cassette recorder (if the interference comes from the original cassette recorder it will be heard on the recording). If the interference persists provide positive lead of cassette recorder with an interference-suppression filter, e.g. 0 290 003 . . .
Relocate the cassette recorder or screen the wiring harness.

7.3 Identification of interference source

The source of interference must be identified from the noise in the loudspeaker.

Ignition interference
Crackling and frying noise, depending on the speed.
Rev engine with vehicle stationary. Then switch off ignition.
Noise should disappear when ignition is switched off.

Generator/alternator interference
Howling with quiet, uniform crackling depending on the speed. Rev engine with vehicle stationary, switch on loads and switch off ignition.
Noise is still audible even after ignition has been switched of and decreases along with the engine speed as the engine comes to a stop.

Regulator interference
Clicking and crackling only occurring in certain load and speed ranges.

Allow engine to run at a high idle speed until noise is audible. Then switch on high-power loads, such as headlamps or rear-window heating.

If the interference changes or if it becomes inaudible when the electrical loads are switched on then the regulator may well be the cause.

Interference caused by voltage stabilizer
Clicking and crackling occurring when ignition is switched on without the engine running. To localize the fault tap gently against the instrument panel. Interference becomes more pronounced

Interference caused by tachometer
Clicking and crackling altering along with engine speed. Disconnect control leads for tachometer at contact-breaker lead and check whether interference persists.

Interference caused by auxiliaries
(Wiper, fan, pump for windscreen washer or headlamp wash-wipe system etc.)
Howling and crackling when auxiliary is switched on
Interference disappears when auxiliary is switched off

Interference caused by static charging
Clicking and crackling on the medium, short and long waves when travelling at high speeds on dry roads.
Interference disappears if service brake and/or handbrake is actuated

Other static interference only occurring during driving (cf. sources of interference, Section 6) is eliminated by ground connections to the vehicle chassis

8. Trouble-shooting programme for interference suppression in motor vehicles

Aim behind trouble-shooting programme
This programme is designed to enable noises in the car radio loudspeaker to be rapidly indentified thus avoidlng both the need for unnecessarily long periods to be spent on trouble-shooting and the costs connected therewith.

Finding the correct page in the programme
Define the customer complaint as precisely as possible.
Look up the faults listed in the table given below:

8.1 Establishment of interference area

Start engine, switch on car radio, set to weak station.

Interference becomes apparent in loudspeaker as	Test procedure	Interference area
Crackling and frying noise dependent on speed.	Rev engine with vehicle stationary. Switch off ignition.	Ignition Section 8.3
	Interference no longer occurs	
High-pitched howling (whining)	Remove electric connector at terminal DF of generator/alternator	Generator/alternator Section 8.4
	Interference no longer occurs	
Interference only at a certain engine speed and load	Allow engine to run at a high idle speed and switch on load (heated rear window, headlamps etc.)	Generator regulator Section 8.5
	Interference no longer occurs	
Interference with loads (blower, wiper motors etc.) switched on	Switch of engine and all loads. Then switch on ignition. Switch on each load individually and determine source of interference	Loads Section 8.6
Interference caused by voltage stabilizer, tachometer, static charging or areal (ground contact)	Test individually	

8.2 Test procedure

The blocks in the trouble-shooting programme are built up in columns.

The left-hand column contains possible causes.

The right-hand column contains further test steps/ repair instructions.

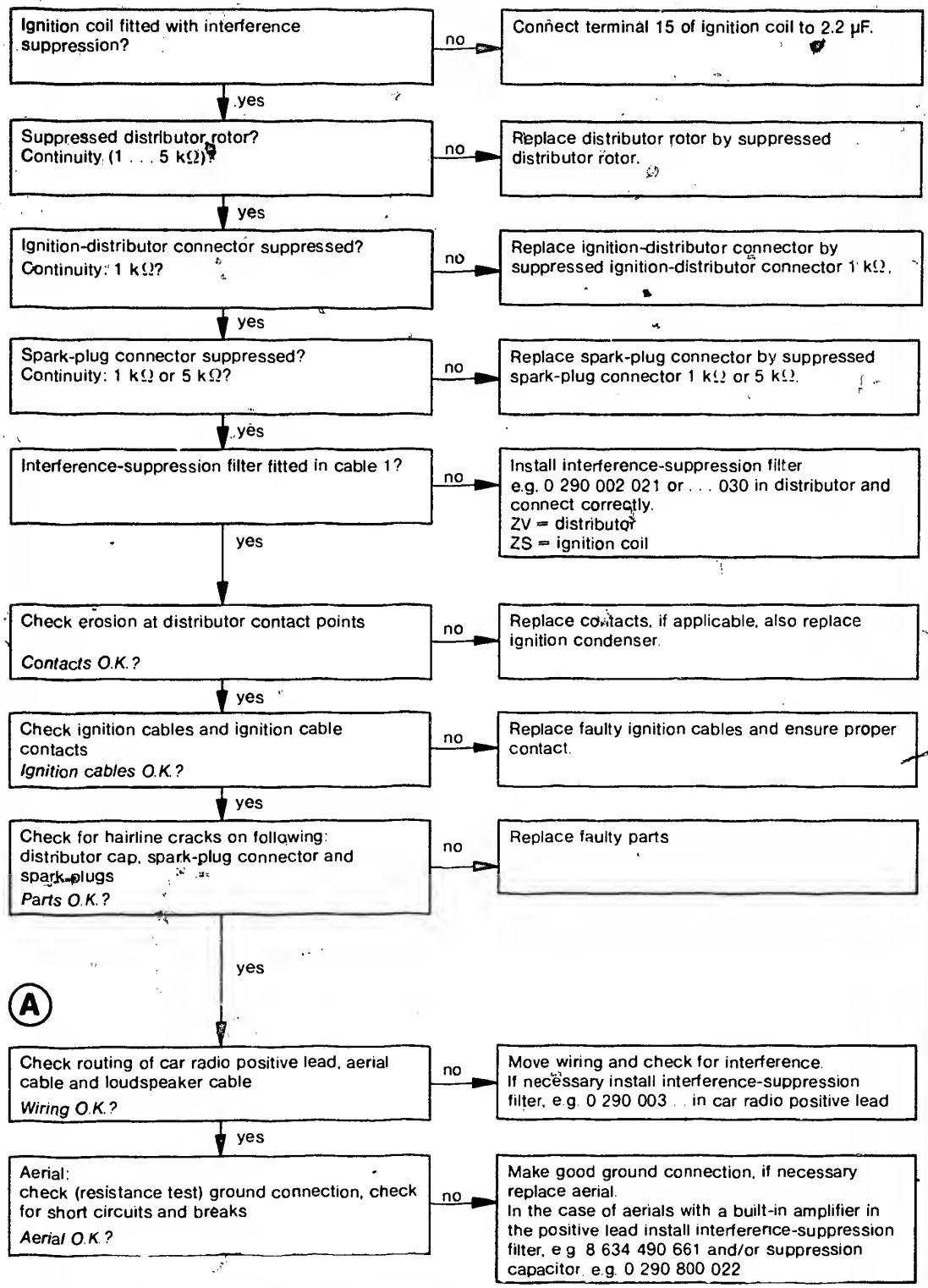
If the questions in the „possible causes" column can definitely be answered in the affirmative without a test being performed, proceed down the list to the next block.

If, on the other hand, a fault is suspected, proceed according to the right-hand column until the fault is located or it is established that the assumed fault is not the cause.

Once the sequence of programme blocks in the right-hand column has been completed, continue tests in accordance with the left-hand column.

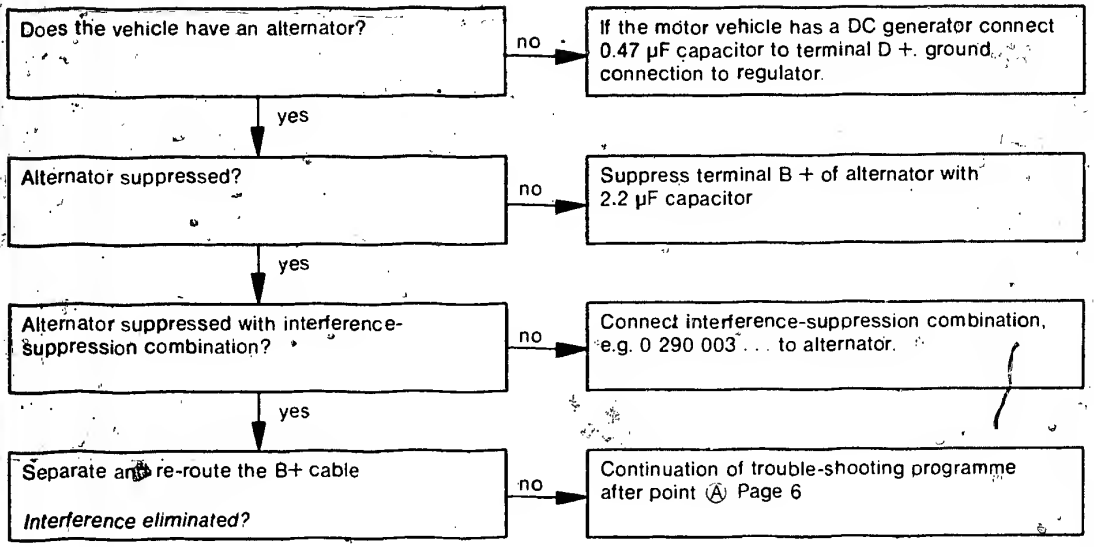
C20

8.3 Interference area – ignition

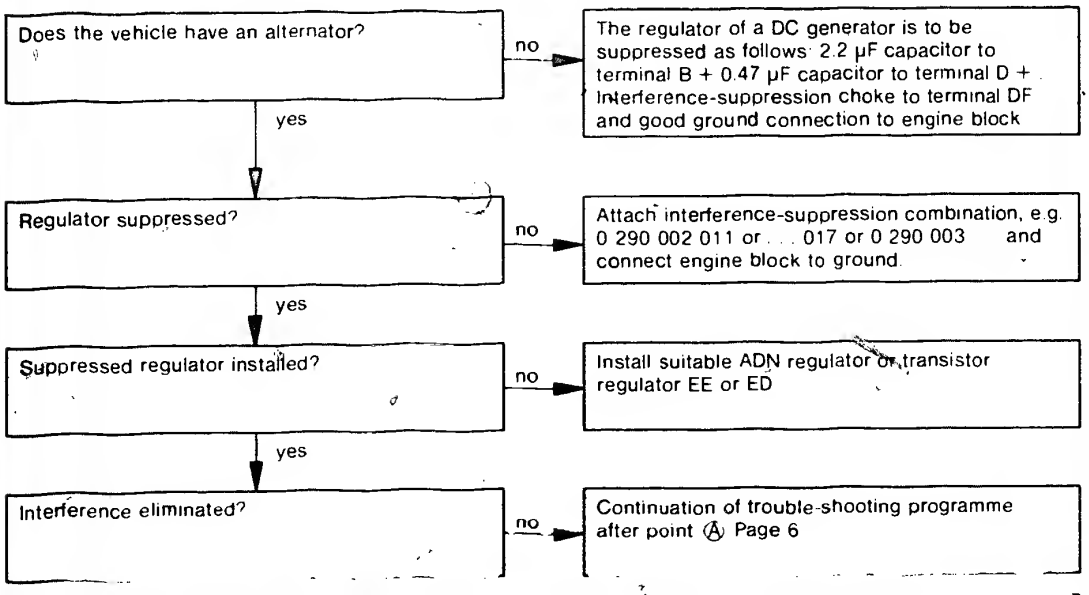


C21

8.4 Interference area – generator/alternator



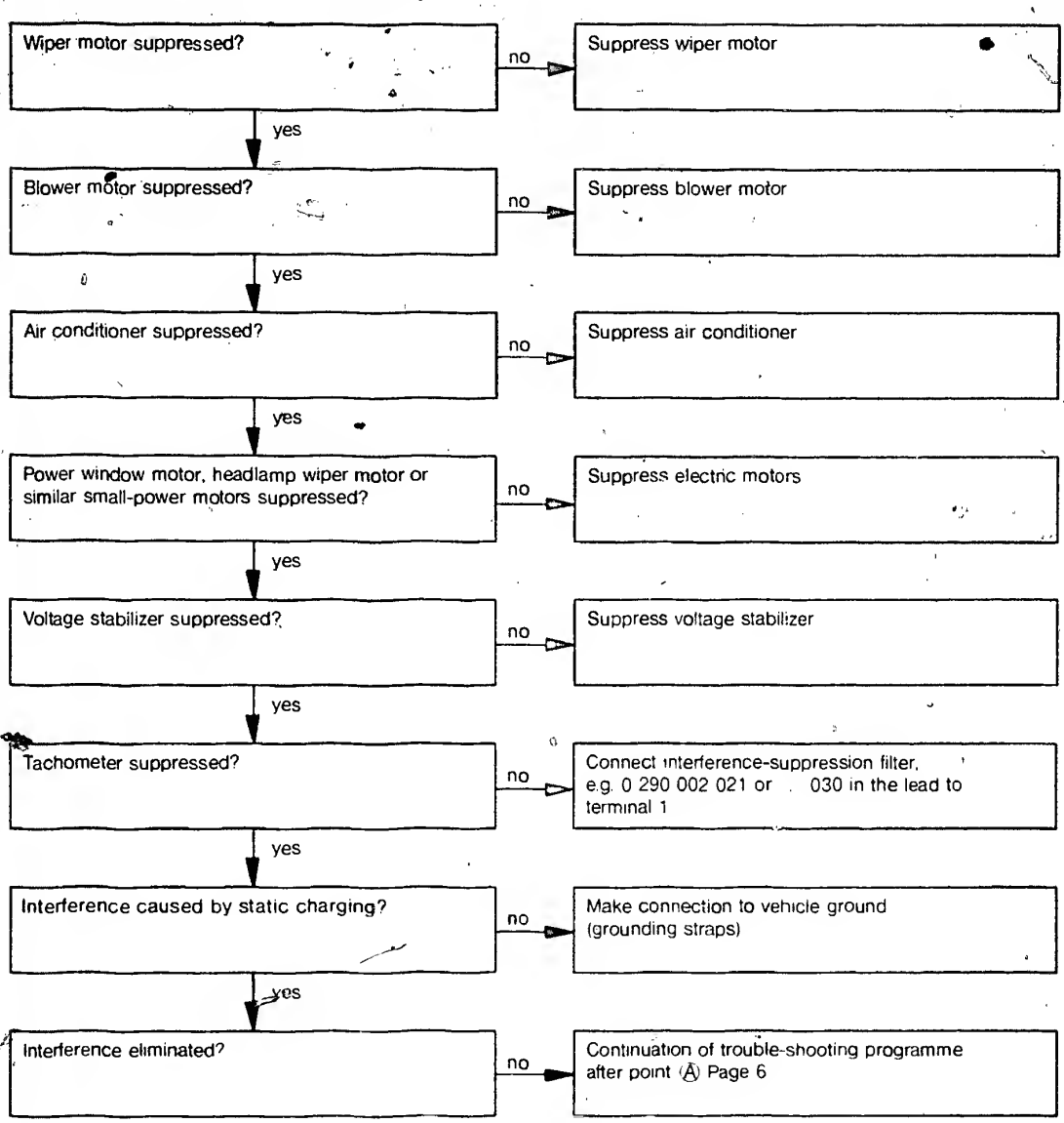
8.5 Interference area – regulator



C22

8.6 Interference area – load

The following interference-suppression devices can be used:
1 297 330 084, 0 290 003 . . . 0 290 002 013



New Product

Electronic Tone-sequence Warning System with Loudspeaker

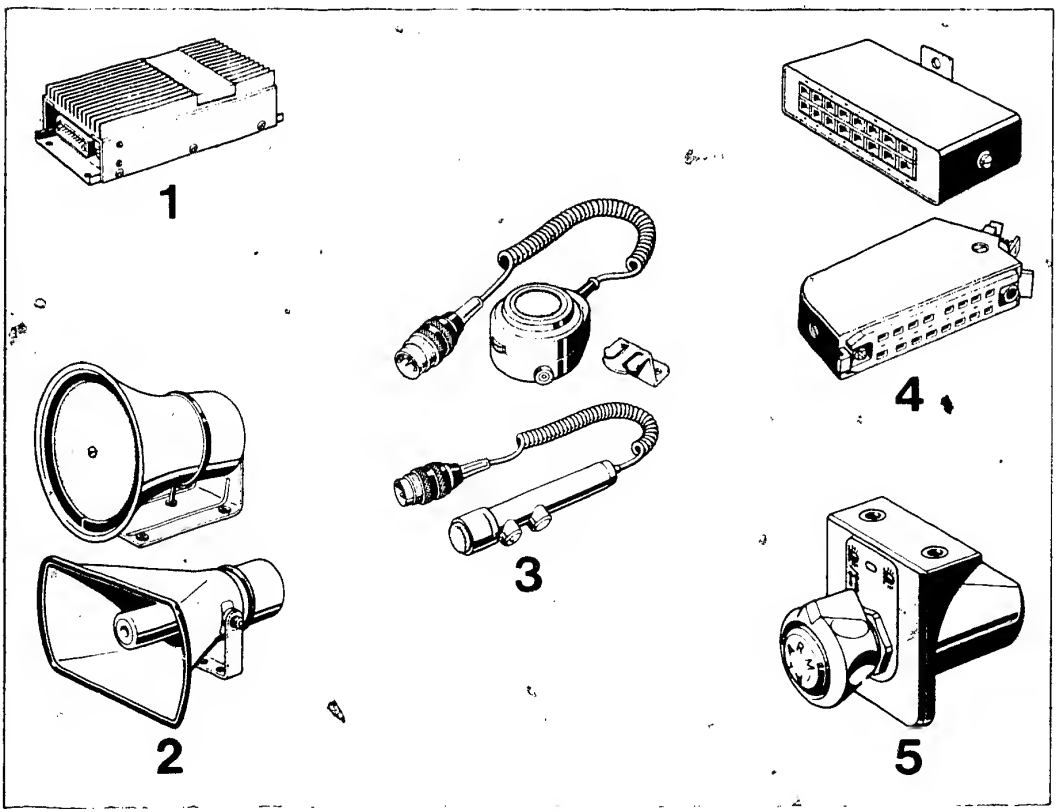
VDT-I-328/1 B
10.1976

Application

This warning and command-post equipment (also known as tone-sequence warning system) is intended for fitting in authorized emergency vehicles. It is an alternative to the tone-sequence warning system using supertone horns, and is suitable for use in police, fire-fighting, rescue, ambulance and disaster-control vehicles.

Components

1 = Electronic audio-frequency oscillator with amplifier (models available for 12 V DC and 24 V DC)
2 = Loudspeaker, round or rectangular
3 = Microphone, to be held in the palm of the hand, or rod-type microphone
4 = Connection parts for item 1
5 = Alarm switch



Method of Operation

1. Warning Signal

The electronic audio-frequency oscillator produces the acoustic tone-sequence warning signal, which is radiated from the loudspeaker.
Usually the loudspeaker is fitted to the vehicle roof. Due to the high output power (75 W), the user has a penetrating warning signal at his disposal. Using the swivel mount, the loudspeaker can be rotated through about 350°.
The normal vehicle horn button is used to initiate a single tone-sequence cycle (low-high-low-high tone). Continuous tone-sequence operation is initiated by the alarm switch.

2. Rotating Beacons

The rotating beacons are produced by Eisemann Ltd and are already in widespread use. They can be put into operation by the alarm switch, either on their own or together with the tone-sequence warning signal.
The beacons can also be operated with the ignition switched off.

3. Microphone

Connecting the microphone permits vocal announcements to be made through the loudspeaker. A speak-button on the microphone switches on the microphone system and interrupts radio communication or the tone-sequence warning signal if it is operating.
The volume of the loudspeaker announcement can be regulated with a control knob on the microphone itself.
Cable-less microphones (without cable connection to the vehicle) can also be used.

4. Radiotelephony

By connecting a two-way radio and the audio-frequency oscillator, announcements received on the radio can be amplified and broadcast over the loadspeaker. A special switch is provided for this facility. The use of the amplifier stage in the audio-frequency oscillator makes an auxiliary amplifier for the radio unnecessary.

5. Priority

Inputs and/or signals are subject to the following priorities:

the tone sequence has priority over radiotelephony announcements,
the microphone has priority over the tone sequence and radiotelephony.

Technical Documentation

A detailed set of installation instructions is included with every equipment.
Technical data is to be found in the KH Information dated 4. 11. 1976.
The part numbers are on microfiche.
Test and repair instructions are being prepared.

VISUAL-INSPECTION CRITERIA FOR PRODUCT WARRANTY ASSESSMENT

VDT-I-328/100 En
7.1979

0 328 .. Compressor fanfare horns

General

In the following table, K3 products are listed which MUST be given a visual inspection before a warranty claim is submitted.

If you discover one of the listed defects, then the warranty claim is to be rejected. The damage concerned is due to improper handling, false fitting, water damage or damage due to impact.

Part-No.	Designation	Warranty inspection criteria - defect	Peason for rejection - cause of defect
0 328...	Compressor fanfare horn	Screw out the compressor cover screws and remove cover	
		Traces of corrosion in axial direction (water damage)	Wrongly fitted (plug not facing downwards)

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C26

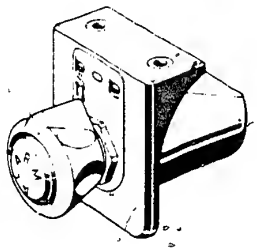
Alarm switch for priority vehicles (with tone-sequence system) 0 341 201 006

Priority vehicles such as police, emergency ambulances, fire brigade have as visual and audible warning systems rotating beacons (blue light) and super-tone horns which are switched on with the alarm switch.

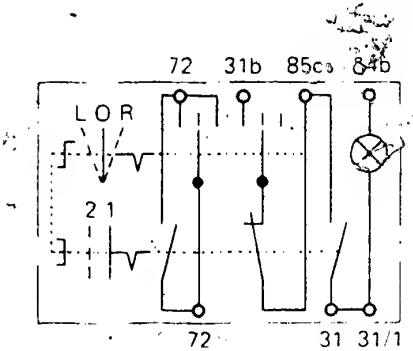
The new alarm switch 0 341 201 006 can be used for both positive and negative-switched normal horn (town horn) as well as for vehicles with either positive or negative battery connection to ground. It replaces the design 0 341 201 005.

On this new alarm switch 0 341 201 006 the connection terminals 31 and 31/1 are connected to each other by a removable bridge. The switch can be used for both the tone-sequence switch 0 335 411 005/.. 006 as well as for 0 335 411 015/.. 016.

For use with 24 V systems the fitted 12 V control lamp must be removed: Osram/Wotan 24 V no. 2741.



Alarm switch 0 341 201 006



Inner circuit thereof

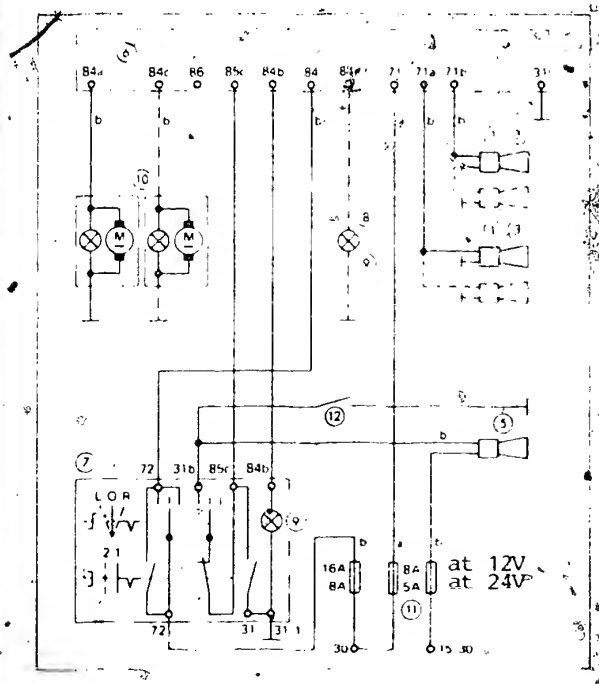
In the circuit diagrams on the following pages the possibilities for use are shown for the new alarm switch 0 341 201 006.

C27

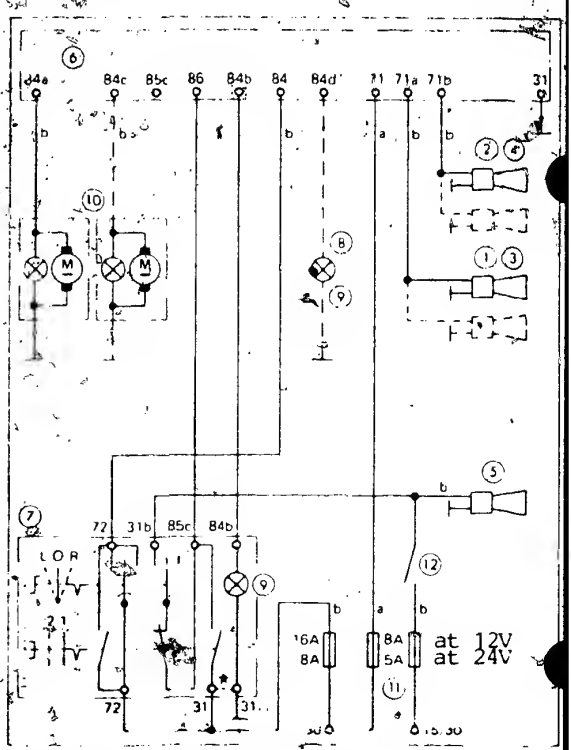
Key to the circuit diagrams

① ... ④	Supertone horns
⑤	Normal horn
⑥	Tone-sequence switch
⑦	Alarm switch
⑧	Indicator lamp for rotating beacon
⑨	Indicator lamp in the alarm switch
⑩	Rotating beacon
⑪	Fuses
⑫	Horn push-button
⑬	Relay (for special circuits)

For vehicles with negative to ground
Normal horn is switched by negative A1



Normal horn is switched by positive A2

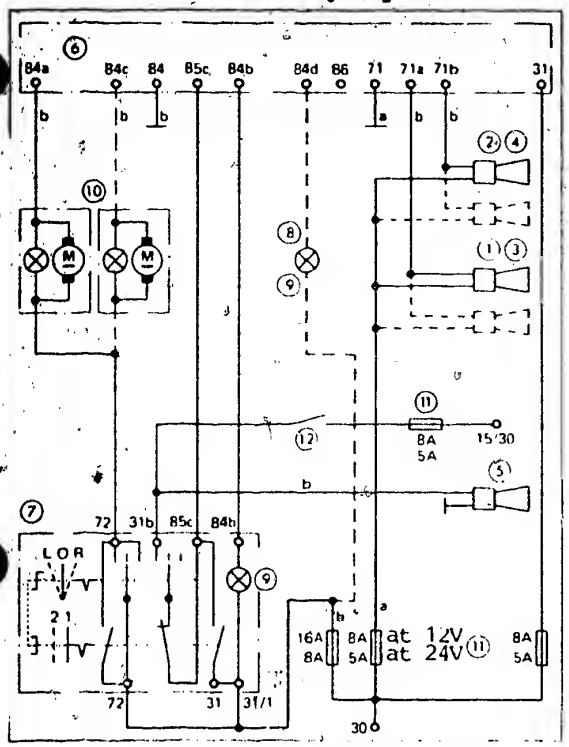


* Remove bridge on alarm switch

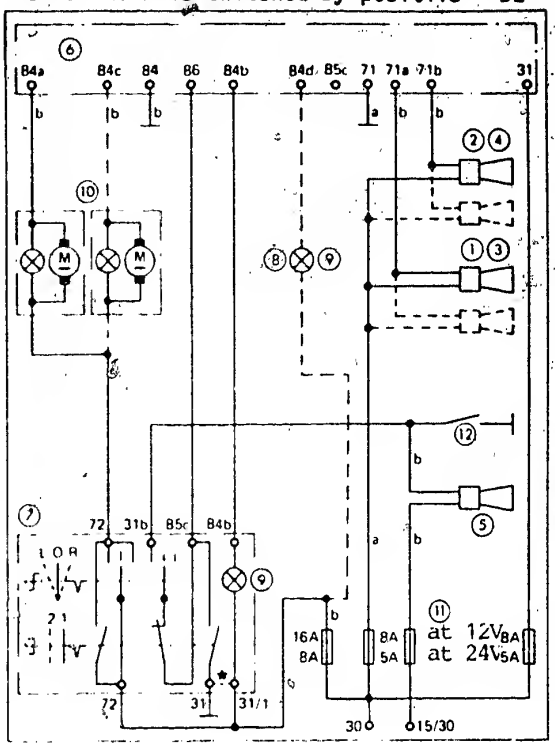
C28

For vehicles with positive to ground (31=+/30=-)

Normal horn is switched by negative B1



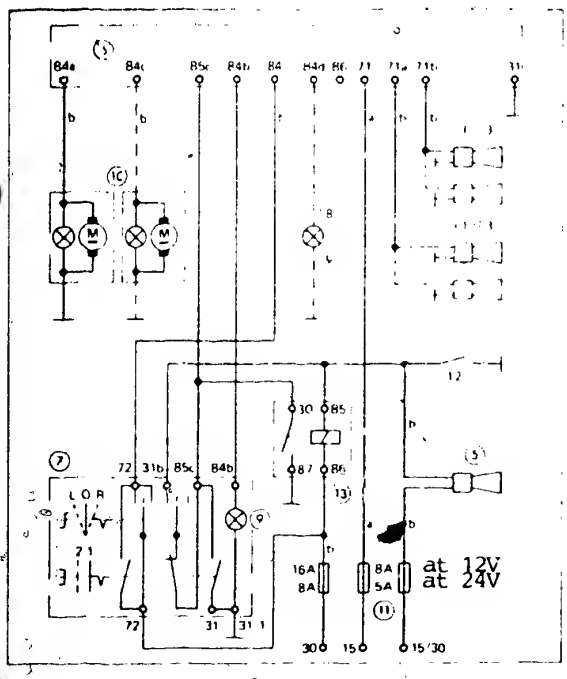
Normal horn is switched by positive B2



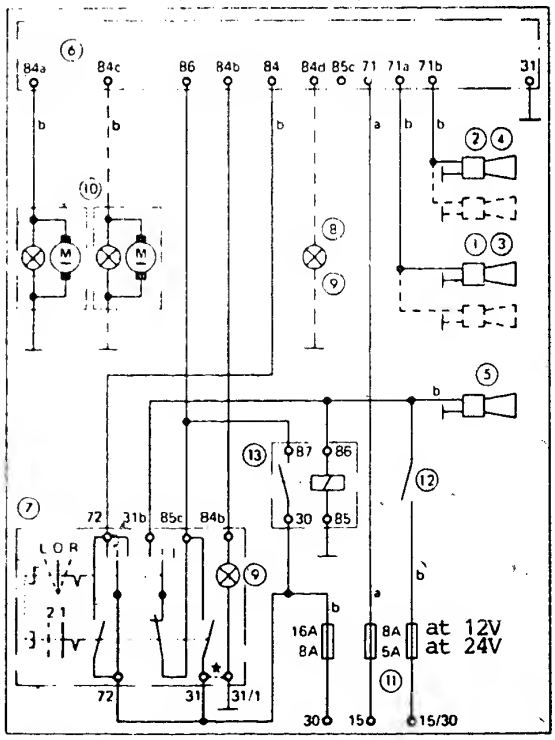
Special circuit for fire-brigade vehicles

For vehicles with negative to ground

Normal horn is switched by negative FA1

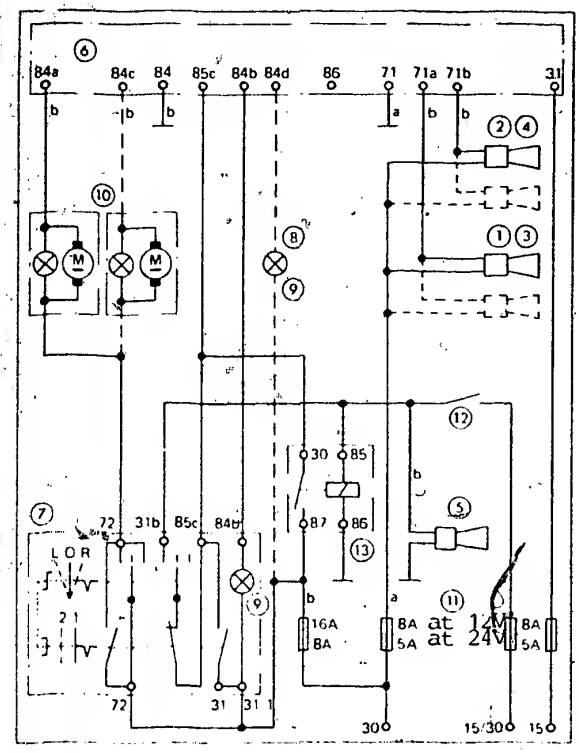


Normal horn is switched by positive FA2

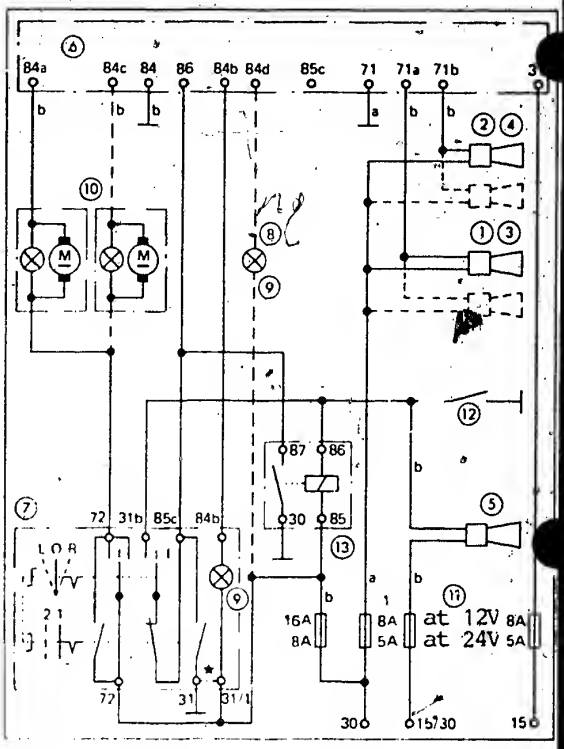


*Remove bridge on alarm switch

For vehicles with positive to ground (31= +/30=-)
Normal horn is switched by negative FB1



Normal horn is switched by positive FB



* Remove bridge on alarm switch

D2

New Product

VDT-I-335/8 En
3.1981

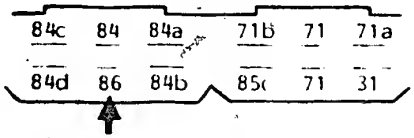
ELECTRONIC TONE-SEQUENCE CONTROL DEVICE

0 335 411 015
and 0 335 411 016

The electronic tone-sequence control device is intended for installation in priority vehicles. This is a new, improved version which supersedes the previous types 0 335 411 005 and ... 006:

0 335 411 015 Rated voltage 12 V
0 335 411 016 Rated voltage 24 V

Terminal identification 0 335 411 015 and ... 016



The types ... 015/016 are fully interchangeable with the types ... 005/006. It is only necessary to remove the locking pin (arrow) on terminal 86 (positive control input).

The new tone-sequence control device can be triggered with either PLUS or NEGATIVE as required from the horn push-button.

Additional safety feature: An internal interlock circuit ensures that the tone sequence can only take place when the rotating beacons are in operation.

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D3

D3 F5

This information is available only in German. If necessary, please contact your regional representative.

Cette information n'est disponible qu'en allemand. Le cas échéant, veuillez vous adresser à votre représentation régionale.

Esta información está disponible únicamente en alemán. En caso necesario, sírvase dirigirse a su Representación Regional.

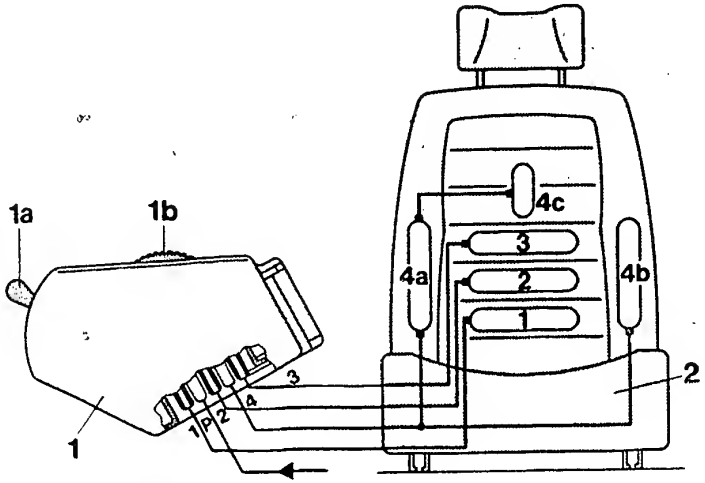
Questa informazione è disponibile solo in lingua tedesca. Se necessario, rivolgersi al proprio rappresentante di zona.

New System

Electrical Equipment

VDT-I-Gen. 065 En
5.1984

ORTHOPAEDIC SEAT ADJUSTMENT, BI-PRESSURE PUMP 0 132 006 .. Mercedes-Benz 190, E, 280 S...500 SEL



1 = Regulating switch
1a = Selector for cushions 1 to 4
1b = Adjuster wheel for pressure regulation (infinitely variable)
2 = Seat with 6 air cushions

Since September 1983 an orthopaedic seat back is available as an optional extra in Mercedes-Benz 190 and 190 E (Type W 201) and since January 1984 in 280 S to 500 SEL (Type W 126).

Motor Vehicle Service Information

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D5

The system consists of six air cushions built into the back rest, a regulating switch, a compressed-air reservoir and a pressure-vacuum pump (bi-pressure pump).

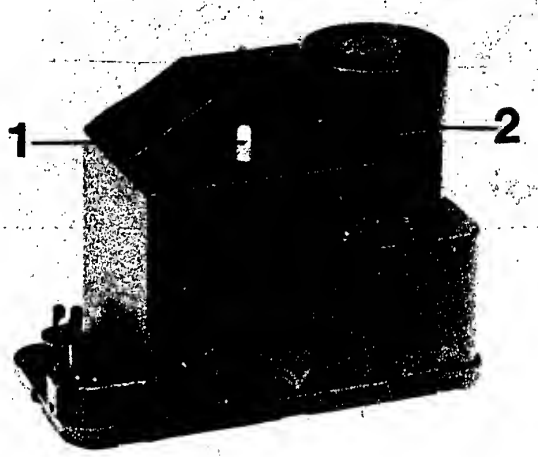
Regulating switch

The air cushions built into the seat back can be selected by means of the selector in the regulating switch with 5 adjustment possibilities (A-B-C-D-E) (see table).

Position of selector	Cushions 1	2	3	4
A	●			●
B	●	●		●
C		●		●
D		●	●	●
E			●	●

The adjuster wheel can be used to regulate the inflation pressure. The regulating switch is supplied with compressed air through connection "P".

On Type W 201 the regulating switch is mounted on the back rest, and on Type W 126 it is mounted on the seat belt buckle.



1 = Connection for orthopaedic seat back
2 = Connection for central locking

Bi-pressure pump

The bi-pressure pump operates up to a pressure/vacuum of 0.59 bar. It is used for the orthopaedic seat back (pressure) and for the central locking system (pressure/vacuum). A safety circuit ensures that pressure/vacuum is supplied by priority to the central locking system. In the case of a leak in the system the pump switches off automatically after a certain length of time.

Please direct questions and comments concerning the contents to our authorized representative in your country.

New product

Bosch car alarm

VDT-I-335/3 En
7.1978

Electronic anti-theft alarm system for all motor vehicles with 12 V systems.

This alarm system is supplied as a mounting kit specially for retrofitting in motor vehicles.
It is an electronic alarm system with door-contact safety system, contact switches for engine hood and luggage compartment lid as well as simultaneous permanent ignition interlock and additional anti-theft protection for the car radio. Basically, the alarm system comprises 2 main sections:

1. The electronic circuit and 2 relays are located in a flat, black plastic housing with 2 multiple plug connections. This is called the "Alarm relay".

2. The built-in on-off switch for the system is installed in a waterproof safety lock. This is called the "Alarm switch".

Functions

1. With the alarm system primed:
   The horn alarm signal sounds at intervals (for a maximum of 30 seconds) immediately a vehicle door, the hood or the luggage compartment are opened.
   At the same time, the ignition system, or in the case of diesel vehicles, the glow-plug and starter switch are subject to a permanent lock.

2. With the alarm system primed:
   The alarm signal sounds each time an attempt is made at:
   Opening the door, luggage compartment lid or engine compartment
   Bridging the ignition switch
   Removing the car radio
   Removing or short-circuiting the connection lead to the alarm switch.

When a further attempt is made to carry out any of the above, the alarm signal is triggered off again and sounds for 30 seconds.

It is recommended to check the installation position of the horn and, possibly, to change it so that it cannot be put out of operation from the underside of the vehicle. In certain circumstances an additional horn may also be mounted where it is not accessible from the outside.

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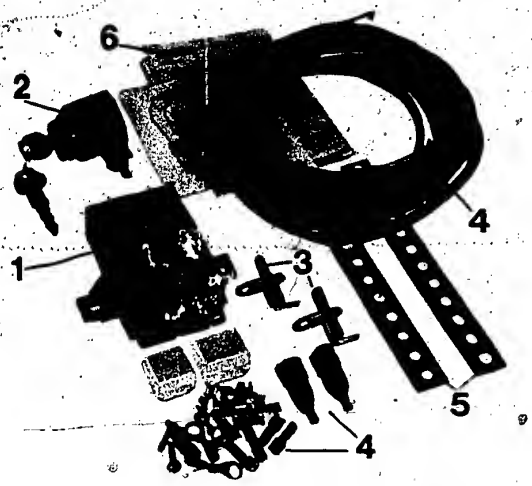


Installation

Installation is carried out in accordance with the installation instructions which accompany each system.
The alarm system is designed for vehicles with negative earth.

Mounting kit components

1 = Electronic alarm relay
2 = Alarm switch with safety lock
3 = Contact switches for engine compartment and luggage compartment lid
4 = Leads, connection parts, screws
5 = Perforated strips for mounting brackets
6 = Detailed installation instructions
7 = Warning signs (for sticking to vehicle window)

D9

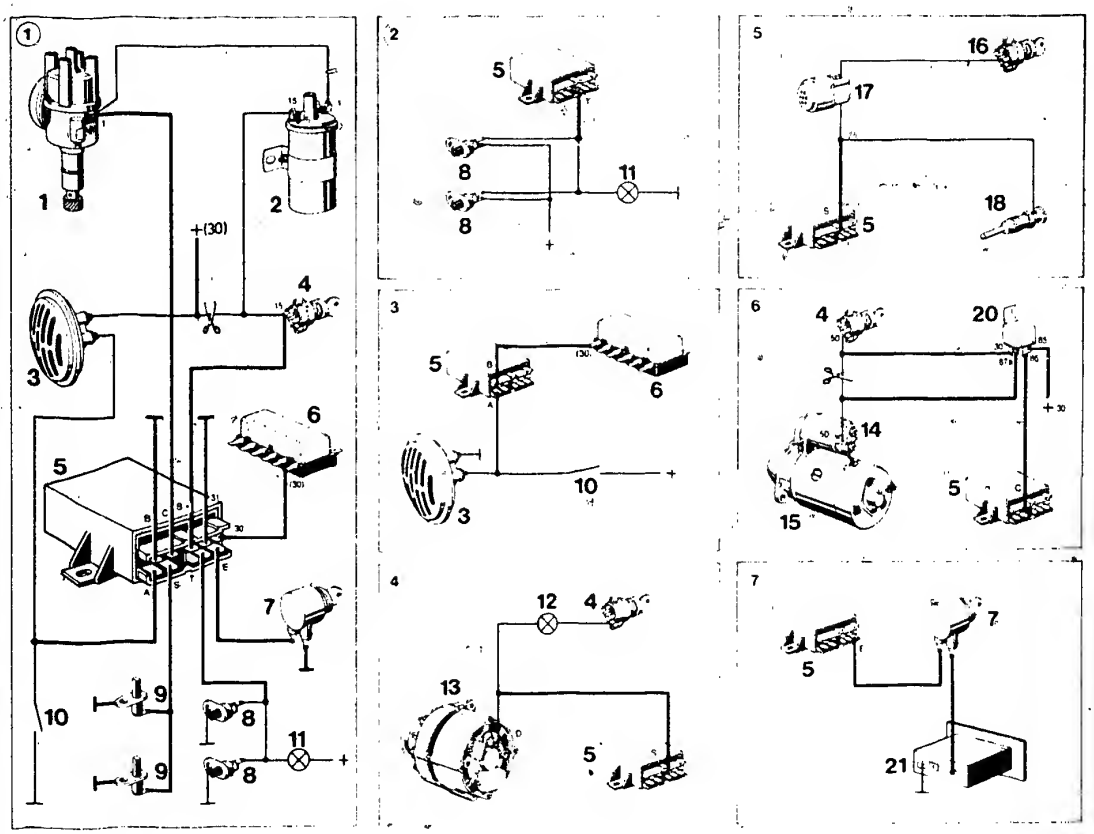
① Basic circuit
② Door contact connects + (positive)
③ Horn button connects + (positive)
④ Safety circuit via generator
⑤ Safety circuit in the case of diesel vehicles
⑥ Alarm triggering system in case of starter actuation
⑦ Safety circuit for radio

The anti-theft safety system for the radio is shown in diagram 7. The earth cable for the alarm switch is not connected to earth at the dashboard; it is connected to the metal housing of the radio in such a way that, should the radio be removed, this **earth cable** is always **separated from the vehicle earth.**

Check the entire installation and electrical connections.

Connect battery.

Check alarm system.



1 = Ignition distributor
2 = Ignition coil
3 = Horn
4 = Ignition switch
5 = Alarm relay
6 = Fuses
7 = Alarm switch
8 = Door contact switch
9 = Contact switch
10 = Horn button
11 = Interior lamp
12 = Charge indicator lamp
13 = Generator
14 = Starter relay
15 = Starting motor
16 = Pre-heating switch, term 19 driving switch (term. 15)
17 = Glow-plug indicator (glow-duration unit, term. G)
18 = Heater plugs
20 = Relay 0 332 204 125
21 = Radio

D10

New Product

New alarm relay 0 335 411 013
for the car-alarm system

The alarm relay 0 335 411 010 has been replaced by the further developed version 0 335 411 013 which has been available from aftermarket sources since 11.1977. The new relay incorporates the following modifications:

1. An additional plug-in connection (designated "K" on some of the earlier models and later on "Z") for the use of auxiliary alarm devices such as a wheel-protection unit etc.

2. The security against interference from radio transmitters (triggering of false alarm) has been extended to such a degree that even transmitters with a power output of up to 20W do not trigger the alarm.

3. The shunt-path sensitivity (referred to dampness and humidity) has been reduced. This is intended to prevent the triggering of false alarms due to dampness and moisture at the contacts fitted to engine hood, doors and luggage compartment (trunk).

4. The alarm pulse for the horn has been increased in amplitude.

At the same time, attention is drawn to the fact that alarm-switch ground connection is to be perfect. This applies whether the connection is via the radio or direct. The best method is to connect a negative line to Term. 31 of the alarm relay. If there is a loose contact in the negative line this will inevitably trigger the alarm.

The alarm relay is not to be fitted in a visible position in the engine or passenger compartment. It is advisable though, to show the customer where the alarm relay is fitted. He is then able to switch the alarm off by pulling the 6-pin plug (this is the larger of the two plugs) in the case of a false alarm (due for instance to an accident etc.).

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New Product

VDT-I-335/5 En

10.1980
Replaces Ed. 6.1980

BOSCH CAR ALARM

New alarm systems

Bosch Car Alarm I	0 335 411 904
Bosch Car Alarm II	0 335 411 901
Bosch Car Alarm Microtronic II	0 335 411 903

Car Alarm I 0 335 411 904

New alarm system with inbuilt delay after "priming".

The system comprises:
- 1 Alarm relay
- 1 Alarm switch (2-pole push-pull switch)
- 1 Horn
- 2 Contact switches (for luggage-compartment lid and hood)

Function (as compared to Car Alarm II)

See Technical Bulletin "New Product" VDT-I-335/3 En, Suppl. 1.

Installation in the vehicle is simpler. The alarm switch (push-pull switch) is not mounted in the outside bodywork, but hidden inside the vehicle in the vicinity of the driver's seat.

Triggering is due to every sudden negative voltage change in the vehicle electrical network (a change of at least 50 mV is necessary). This occurs every time a load (as from about 3 W) is switched on. Only a few lines need to be laid.

Method of operation

The alarm switch has a normally open and a normally closed contact. When the system is "primed", the normally-open contact switches the alarm relay on. The normally-closed contact open-circuits the primary ignition line to the ignition coil terminal 15. In the case of vehicles with electronic ignition systems, or with diesel engines, the line 50 to the starting motor is open-circuited (via the extra relay).

After the alarm switch has been switched on, the installation is primed after a delay of between 30 and 60 seconds.

Loads which are switched on before the system is primed, or switched off afterwards, do not cause the alarm to sound.

With clocks and tachographs having a magnetic-type wind-up, an additional damping element must be fitted (see Installation Instructions).

After an impulse has been triggered, the alarm sounds intermittently after a delay of 5 seconds. The delay is necessary in order to permit the driver to switch off the system after having opened the door.

On the other hand, the alarm sounds immediately (no delay) when the hood or the luggage-compartment lid are opened, when the negative line from terminal "R" via other loads to ground is open-circuited, or when the backlight is removed or

BOSCH Geschäftsbereich KH Kundendienst, Kfz-Ausrüstung

broken (if fitted with integral heater wires).

If the vehicle is fitted with a battery master switch and this is switched off, then the alarm system is rendered inoperative.

Car Alarm II 0 335 411 901

This system has been available for about 1 year, see Technical Bulletin "New Product" VDT-I-335/3 En and Suppl. 1 (electronic anti-theft alarm system).

Car Alarm Microtronic II 0 335 411 903

This auxiliary equipment can only be operated together with Car Alarm I or II.

Function

Triggering of the alarm is caused as follows:
If the vehicle is lifted from the side, from the front or from the rear. The alarm also sounds if it is winched onto a tow truck or is towed away.

The Microtronic comprises 2 main components:
The vehicle-tilt pickup and the control unit.

The vehicle-tilt pickup is to be fitted in as horizontal a position as possible. It contains 2 fixed coils which are located at right angles to one another. Above these, two pivoting short-circuit rings are mounted. The pickup is damped by means of a liquid in order to prevent false alarm in the case of minor shakes and tremors. The inductive values of the coils at the moment the vehicle is parked are transmitted to the control unit by means of a 3-core cable. Here, the inductive values are transformed into oscillatory frequencies.

Method of operation

When it is parked, the vehicle's position is stored as the nominal value as soon as the system is "primed". The nominal value depends upon whether the vehicle is parked on the flat, on a hill or partly on a curbstone.

The time required for the system to adapt to the nominal value is approx. 50 seconds. During this time, the sensitivity of the pickup is reduced.

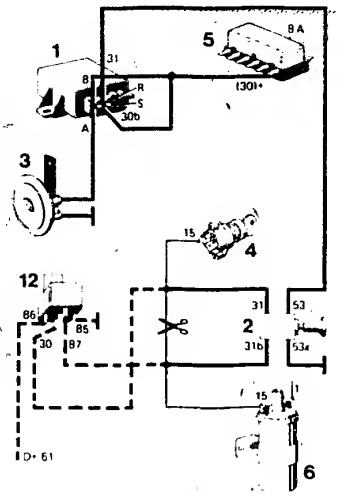
If the position of the vehicle is changed - the actual value differs from the nominal value as a result - the relay in the control unit transmits a signal for about 1 second via term. "S" to the alarm relay and triggers the alrm.

As soon as the alarm has sounded, the new vehicle position is stored again as nominal value. Further vehicle movements (lifting, lowering and towing-away etc.) cause the alarm to sound again.

Movements due to the wind or lightly pushing down by hand do not trigger the alarm, neither do extremely slow changes in position resulting from snowfall or loss of tire pressure.

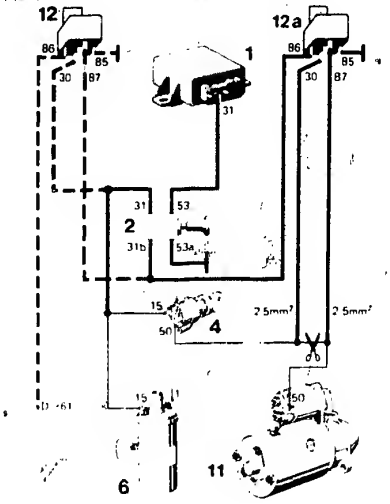
Basic circuit BOSCH Car alarm 1

(1)



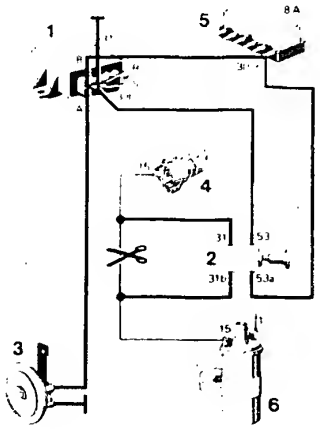
Basic circuit with ignition block.
Alarm switch 2 (priming switch) switches negative (-) to alarm relay 1.
An extra safety relay (12) is fitted in order to prevent the ignition being blocked whilst driving.

(2)



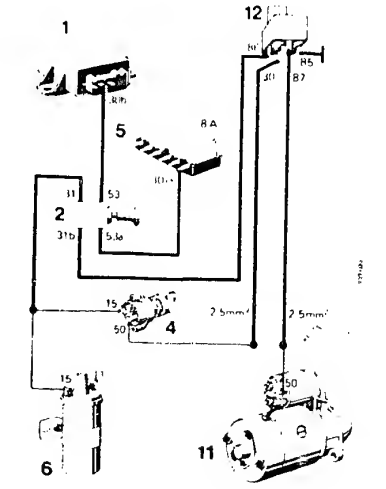
Basic circuit with starting block via additional relay 12 a.
Alarm switch 2 (priming switch) switches negative (-) to alarm relay 1.
An extra safety (12) is fitted in order to prevent the ignition being blocked whilst driving.

(1a)



Basic circuit with starting block.
Alarm relay 2 (priming switch) switches positive (+) to alarm relay 1 (former circuit without safety relay 12).

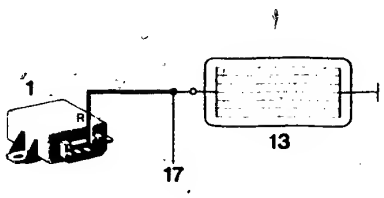
(2a)



Basic circuit with starting block via additional relay 12 a.
Alarm switch 2 (priming switch) switches (+) to alarm relay 1 (former circuit without safety relay 12).

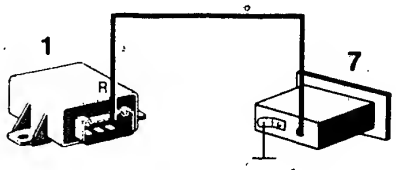
D14

(3)



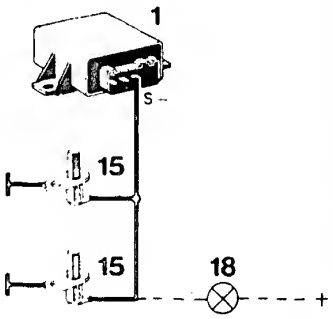
Additional circuit safeguarding the backlight via the backlight heating.

(6)



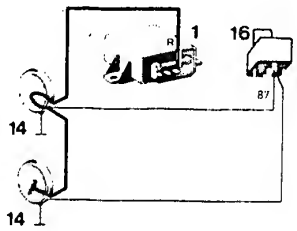
Additional circuit safeguarding the car radio (nor permitted in the Federal Republic of Germany).

(4)



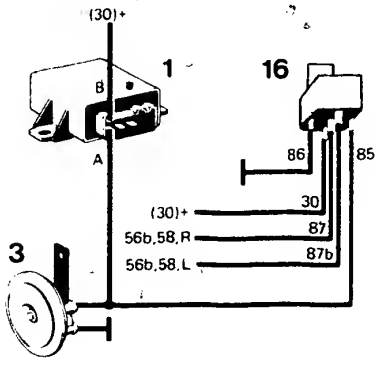
Additional circuit safeguarding the luggage compartment and engine compartment via 2 contact switches 15.

(7)



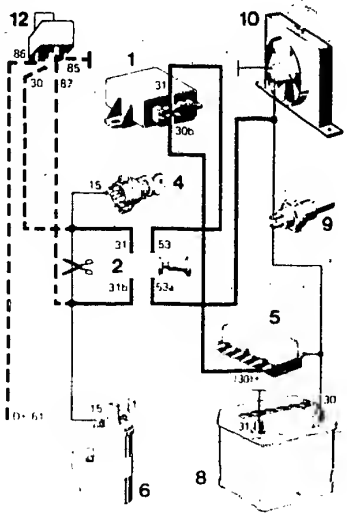
Additional circuit safeguarding the auxiliary lamps (not permitted in the Federal Republic of Germany).

(5)



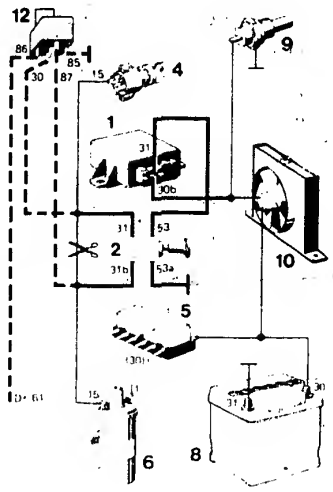
Additional circuit for simultaneous visual alarm via additional relay 16 (not permitted in the Federal Republic of Germany).

(8)



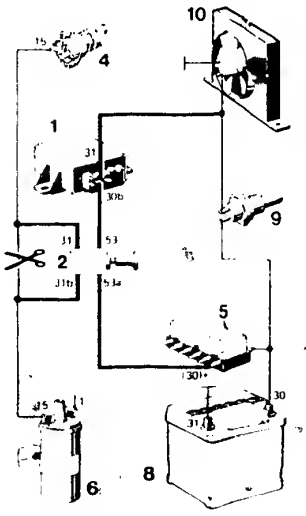
Prevention of the alarm sounding when the vehicle is parked and the ventilator fan (+ switched) is switched on.
Alarm switch 2 switches negative (-) to alarm relay 1.
An extra safety relay 12 is fitted in order to prevent the ignition being switched off whilst driving.

(9)



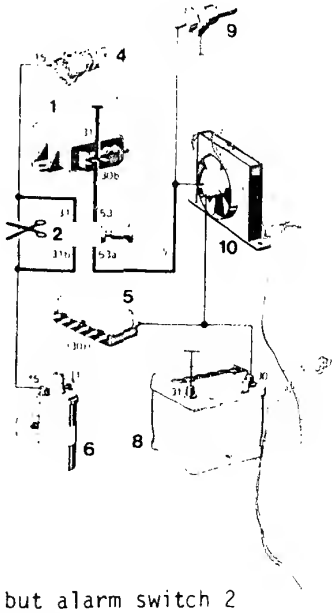
Prevention of the alarm sounding when the vehicle is parked and the ventilator fan (- switched) is switched on.
An extra safety relay 12 is fitted in order to prevent the ignition being switched off whilst driving.

(8a)



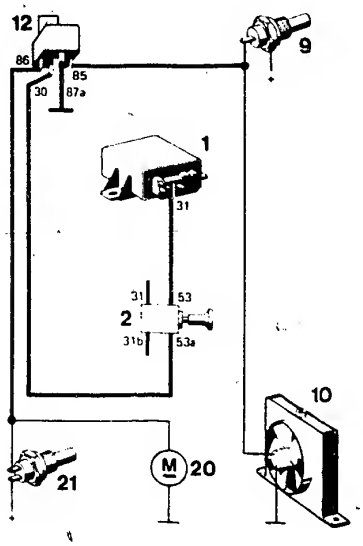
As Fig. 8, but only alarm switch 2 switches positive (+) to alarm relay 1 (former circuit without safety relay 12).

(9a)



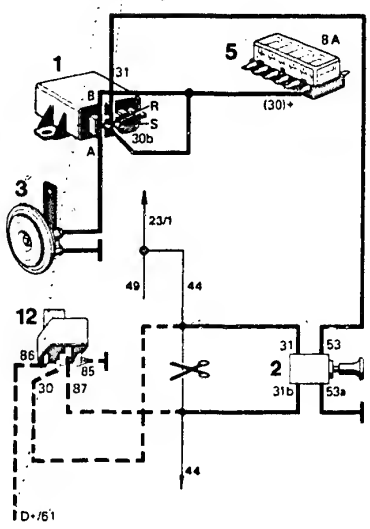
As Fig. 9, but alarm switch 2 switches negative (-) to alarm relay 1
(former circuit without safety relay 12).

(10)



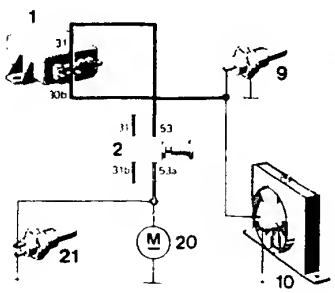
Prevention of the alarm sounding via relay 12 when the vehicle is parked and the heater blower motor 20 (+ switched) switches on in connection with the auxiliary heating.

(12)

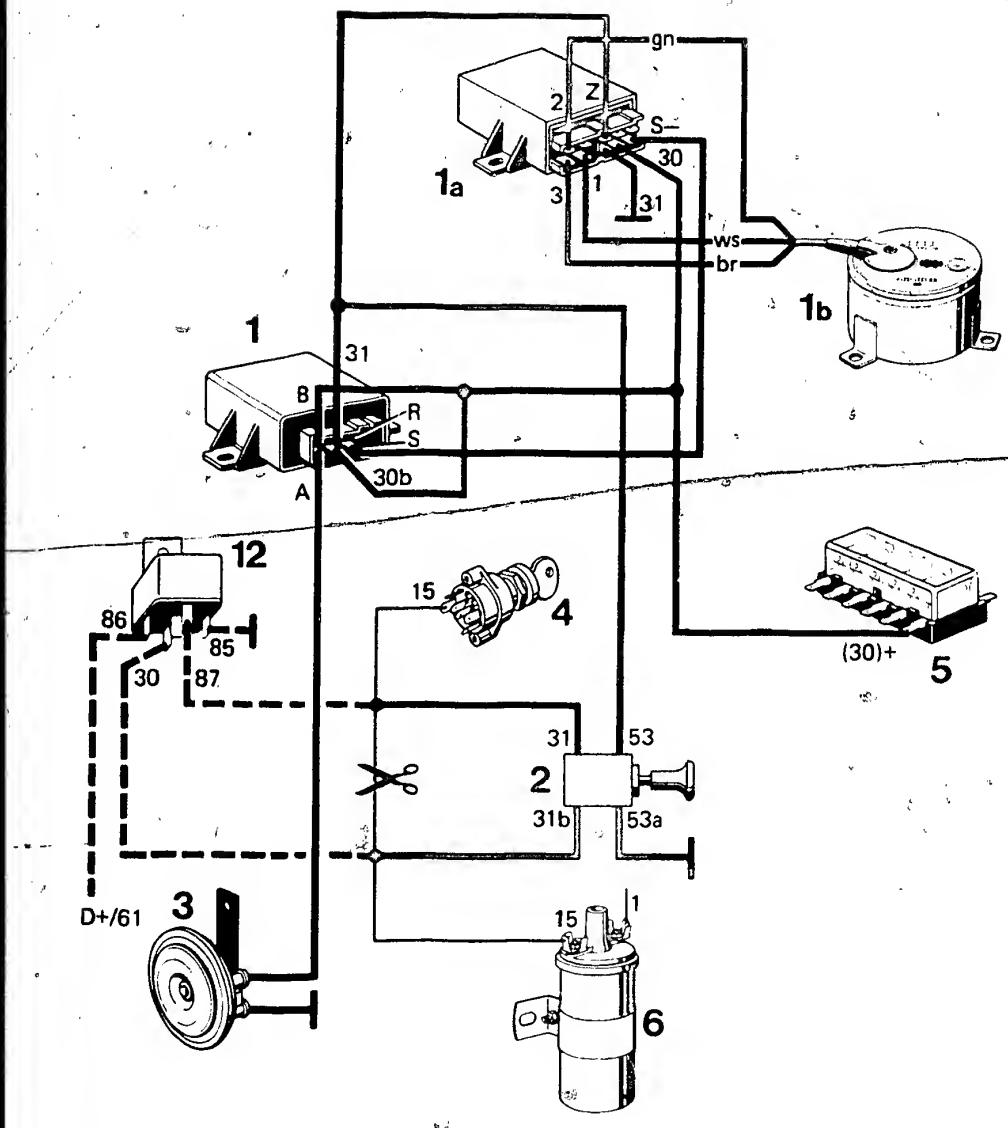


Alarm circuit for Motronic-equipped vehicles.
An extra safety relay 12 is fitted in order to prevent the ignition being switched off whilst driving.

(11)



As Fig. 10, but with heater blower switched negative (-).



⑬ Wiring diagram for the BOSCH Car alarm 1 with Motronic II

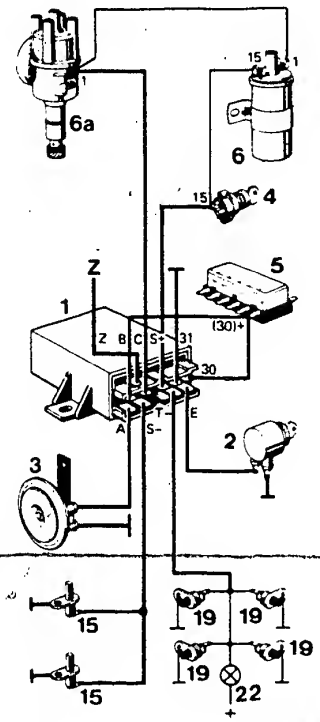
Explanatory notes on the items in wiring diagrams ① to ⑬

1 = Alarm relay
1a = Control unit (evaluation electronics)
1b = Vehicle-tilt pickup
2 = Alarm switch (priming switch)
3 = Alarm horn
4 = Ignition and starting switch
5 = Fuse box with 8 A fuse
6 = Ignition coil
7 = Radio
8 = Battery
9 = Thermo-switch or relay
10 = Radiator fan
11 = Starting motor
12 = Relay 0 332 014 125 (change-over contact, here as make contact)
13 = Heated rear window (backlight)
~~14 = Auxiliary headlamps~~
15 = Contact switch (e.g. for engine and luggage compartment lid)
16 = Extra relay 0 332 015 001 (twin make contacts)
17 = To switch or relay for rear window heating (backlight heating)
18 = Luggage or engine compartment light
20 = Heater blower motor
21 = Thermostat switch for heater blower motor
23/1 = To Motronic control unit
44 = To main relay terminal 85 of the Motronic
49 = To temperature sensor 2

ws = white
gn = green
br = brown

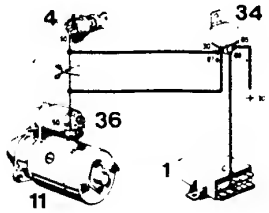
Basic circuit BOSCH Car Alarm II with variations of the basic circuit and extra circuits

(14)



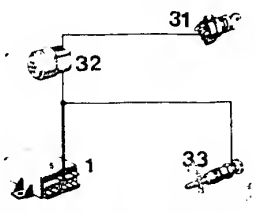
Basic circuit with ignition block (not for electronic ignition systems or for Motronic)

(15)



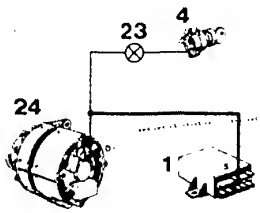
Variation of basic circuit 14 : with starting block for vehicles with electronic ignition and Motronic

(16)



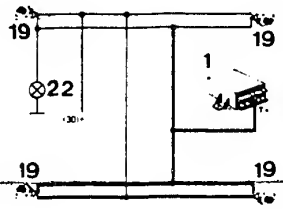
Variation of basic circuit 14 : for diesel vehicles

(17)



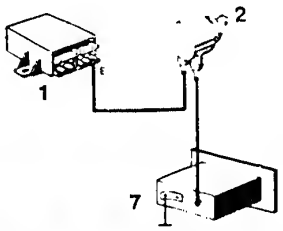
Variation of basic circuit 14 : alarm triggered off by running alternator.

(18)



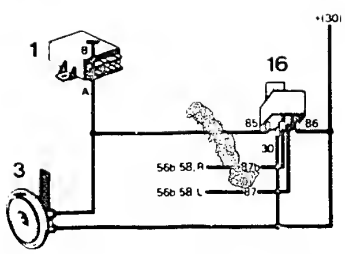
Extra circuit: rear-door contacts (+ switched)

(19)



Extra circuit safeguarding the car radio (not permitted in the Federal Republic of Germany)

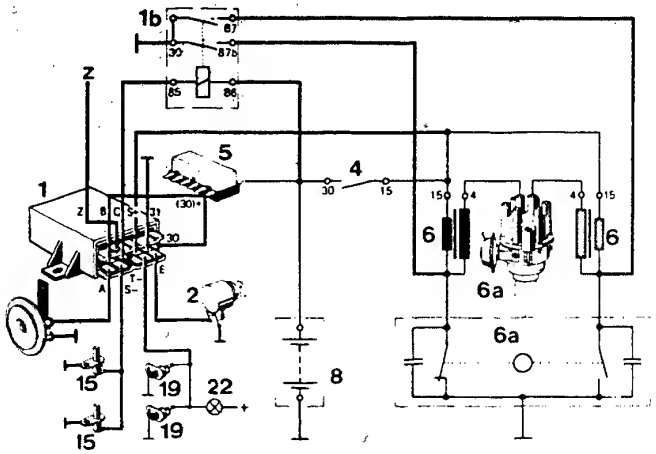
(20)



Extra circuit for simultaneous visual alarm via extra relay 16 (not permitted in the Federal Republic of Germany)

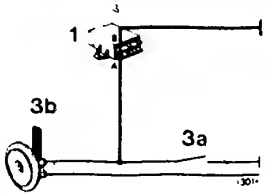
D20

(21)



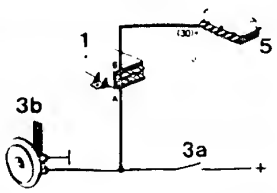
Special circuit for Peugeot 604 with double contact breaker

(22)



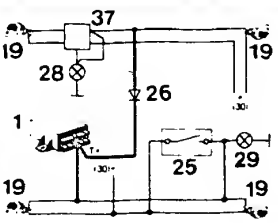
Special circuit: series-fitted horn, horn button switches negative (-).

(23)



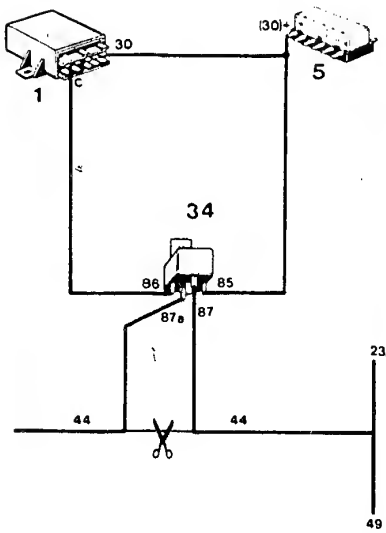
Special circuit: series-fitted horn, horn button switches positive (+).

(24)

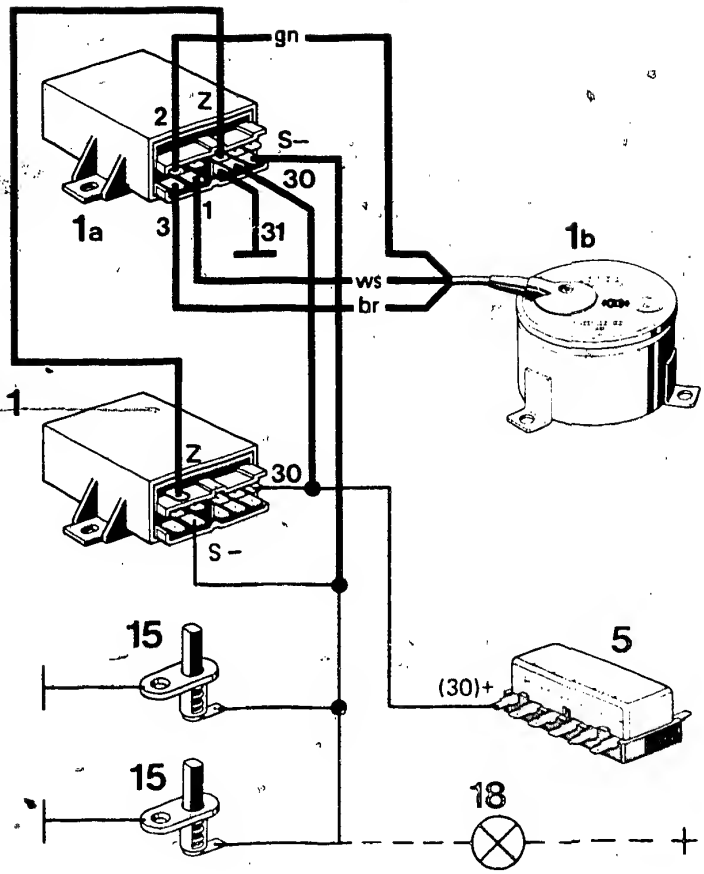


Special circuit: Mercedes-Benz with front and rear inner lights

(25)



Special circuit for vehicles with Motronic (with ignition block).



gn = green
br = brown
ws = white

(26) Wiring diagram for the BOSCH Car Alarm II with Microtronic II

Explanatory notes on the items in wiring diagrams (14) to (26)

1 = Alarm relay
1a = Control unit
1b = Vehicle-tilt pickup
2 = Alarm switch (priming switch)
3 = Alarm horn
3a = Button for series-fitted horn
3b = Series-fitted horn
4 = Ignition and starting switch
5 = Fuse box with 8 A fuse
6 = Ignition coil
7 = Radio
8 = Battery
11 = Starting motor
12 = Relay 0 332 014 125 (change-over contact, here as make contact)
15 = Contact switch (e.g. for engine and luggage compartment lid)
16 = Extra relay 0 332 015 001 (twin make contacts)
18 = Luggage or engine compartment light
19 = Door-contact switch
22 = Interior light
23 = Charge indicator lamp
23/1 = To Motronic control unit
24 = Generator / alternator
25 = Hand switch for rear interior light
26 = Blocking diode 0 212 911 001
28 = Front interior light with switch
29 = Rear interior light
31 = Pre-heating switch terminal 19
Driving switch (terminal 15)
32 = Glow-plug indicator
33 = Glow plugs
34 = Relay 0 332 204 125 (change-over contact, here as break contact)
36 = Starting motor relay
37 = Time relay
44 = To main relay terminal 85 of the Motronic
49 = To temperature sensor 2
Z = Additional current-consuming device

ws = white gn = green br = brown

New Product

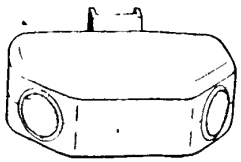
VDT-I-335/9 En
2.1982

BOSCH AUTO ALARM PLUS 4 - 0 986 335 003

Additional ultrasonic interior protection
for Bosch Car Alarm 1 and 2

Bosch Car Alarm plus 4 consists of a three-dimensional ultrasonic movement detector and evaluation electronics, which are connected to the alarm relay of Car Alarm 1 or 2.
When the alarm system is "primed" an ultrasonic field is produced in the vehicle interior (Figs. 2 and 3). The alarm is triggered when there are changes of movement in this field, e.g. when a window is broken or when the convertible top is cut open.

Fig. 1 Ultrasonic movement detector



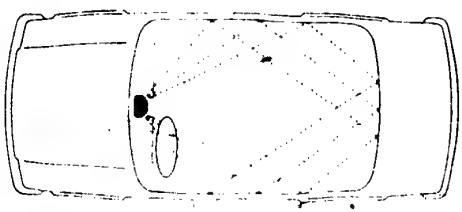


Fig. 2 Ultrasonic movement detector fitted on the rear mirror

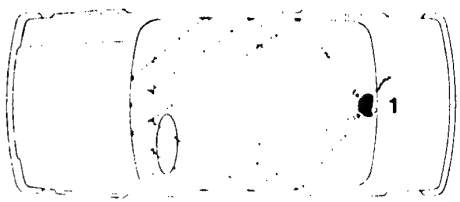


Fig. 3 Ultrasonic movement detector fitted on the rear-window shelf

The responsiveness can be set on a potentiometer on the evaluation electronics. Every time there is a change in the ultrasonic field the alarm is triggered again.

BOSCH
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D24

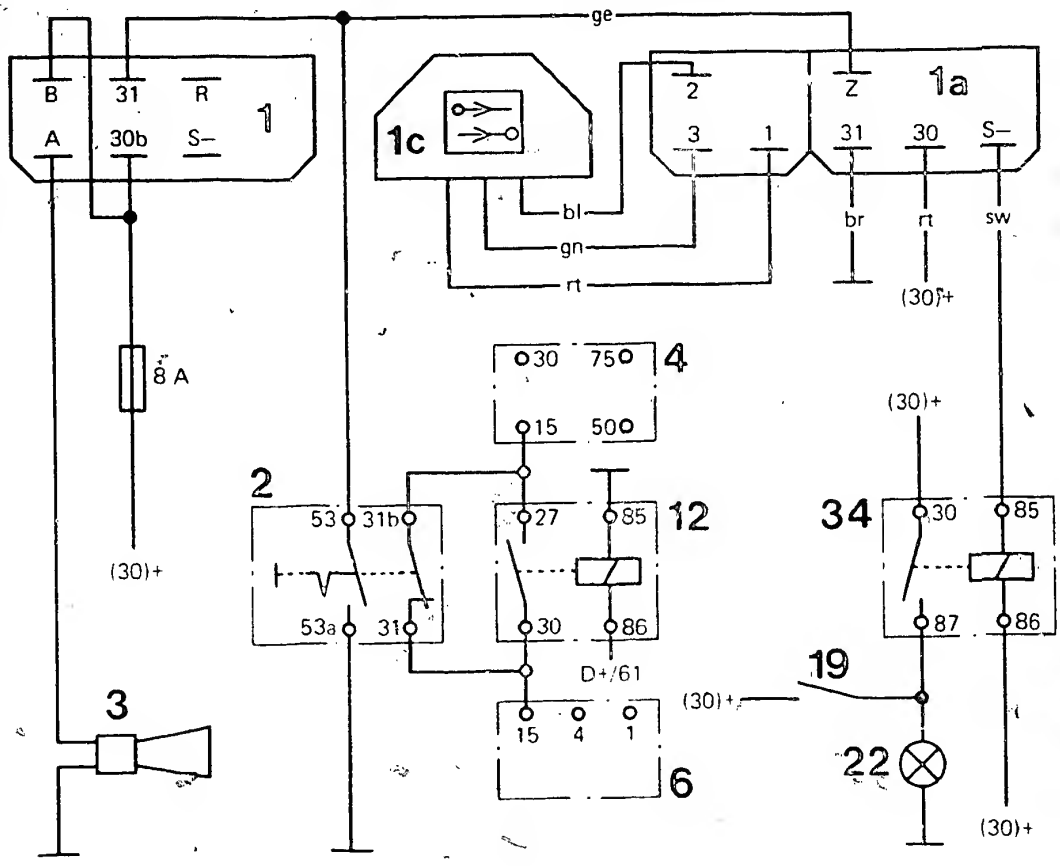
Some of the Bosch car alarm systems have received new designations as follows:

Bosch Car Alarm 1	(as previously - with push-pull switch)
Bosch Car Alarm 2	(as previously - with key-operated switch
Bosch Car Alarm plus 3	(previously "microtronic")
Bosch Car Alarm plus 4	(new: ultrasonic interior protection)

Basic circuit for Car Alarm 1 with ignition blocking

Alarm switch 4 switches minus to the alarm relay. To prevent unintentional switching-off of the ignition during the journey, an additional safety relay must be fitted (12).

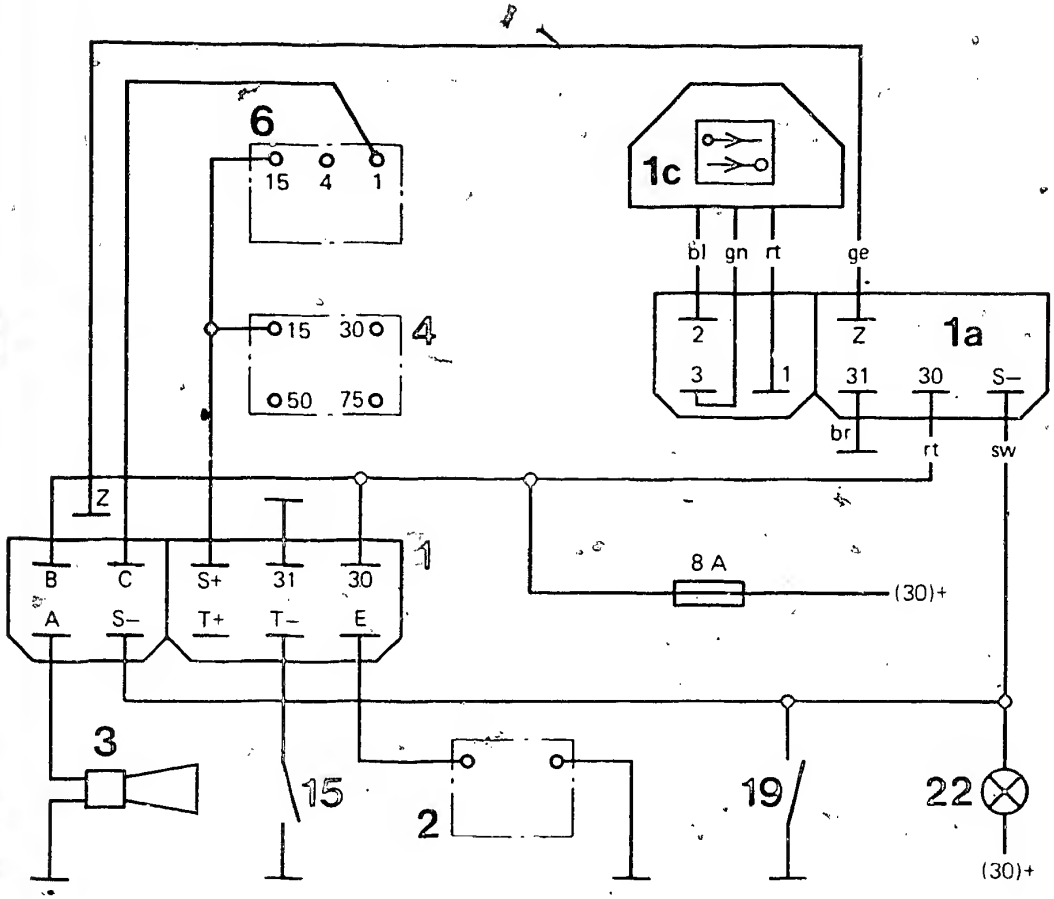
Door contact switches plus



1 = Alarm relay
1a = Evaluation electronics
1c = Ultrasonic movement detector
2 = Alarm switch (push-pull switch)
3 = Alarm horn
4 = Ignition and starting switch
6 = Ignition coil
12 = Safety relay

19 = Door contact
22 = Interior light
34 = Relay 0 332 014 150
bl = blue
br = brown
ge = yellow
gn = green
rt = red
sw = black

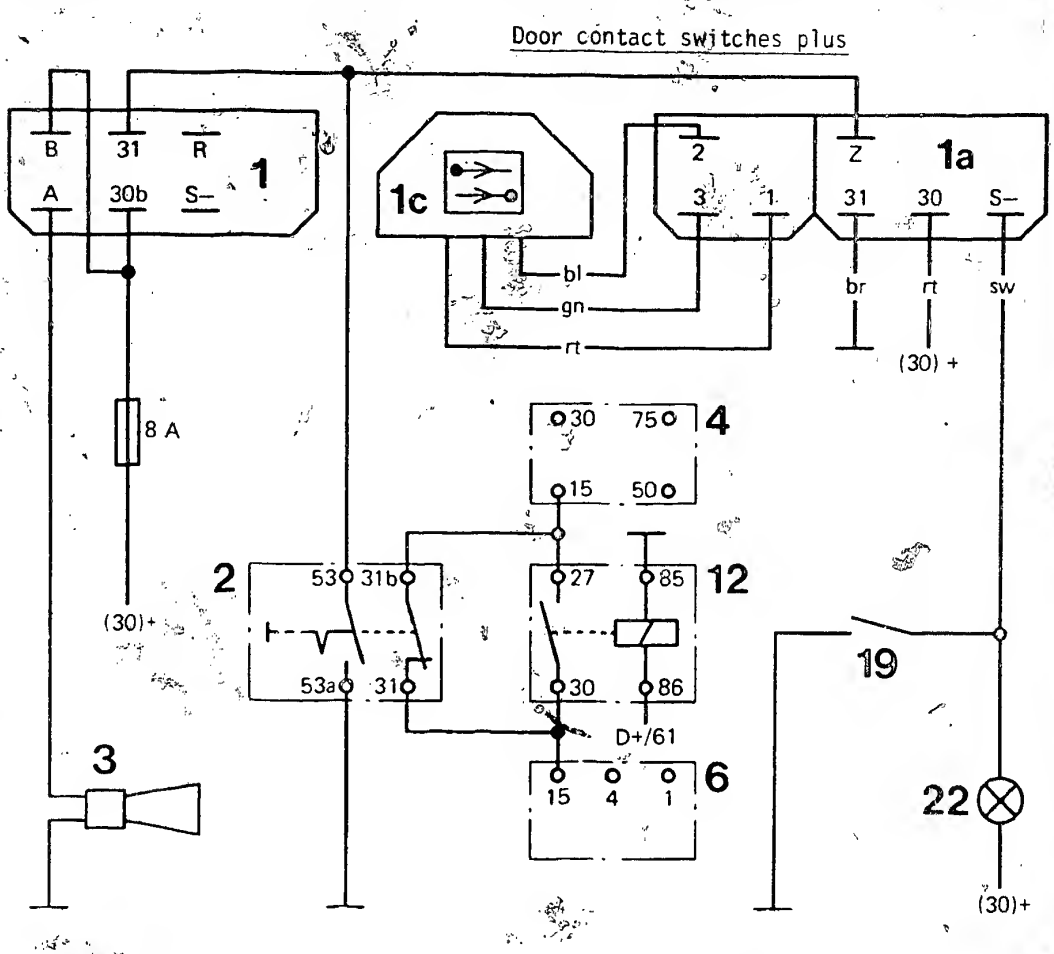
Basic circuit Car Alarm 2 with ignition blocking (does not apply to electronic ignition systems and motronic)



1 = Alarm relay
1a = Evaluation electronics
1c = Ultrasonic movement detector
2 = Alarm switch (key-operated switch)
3 = Alarm horn
4 = Ignition and starting switch
6 = Ignition coil
15 = Contect switch for engine-compartment lid or luggage-compartment lid
19 = Door contact
22 = Interior light
bl = blue
br = brown
ge = yellow
gn = green
rt = red
sw = black

Basic circuit for Car Alarm 1 with ignition blocking

Alarm switch 4 switches minus to the alarm relay. In order to prevent unintentional switching-off of the ignition during the journey, an additional safety relay (12) is fitted.



1	Alarm relay	19	= Door contact
1a	= Evaluating electronics	22	= Interior light
1c	Ultrasonic movement detector	bl	= blue
2	Alarm switch (push-pull switch)	br	= brown
3	Alarm horn	ge	= yellow
4	Ignition and starting switch	gn	= green
6	Ignition coil	rt	= red
12	Safety relay	sw	= black

D27

VDT-I-335/103 B
Ed. 1 8.75
Translation of German edition of 13.6.1975

0 335 210.. and 0 335 215..
Electronic vehicular hazard warning and turn signal flasher for commercial vehicles

Please destroy BME 623/15 B (edition 6.71)

The measures taken up to now to improve the electronic vehicular hazard warning and turn signal flashers in commercial vehicles have more than proved themselves in practice.

However, the incidences of failure of the separate load relay in public transport corporation and German Railways buses have been on the increase lately.

The principal cause of these failures lies in the recommendation from the public transport corporations that the nearside flasher be left in operation when the bus is stationary for the picking up and setting down of passengers, and also in the altered traffic regulations, which require that the flashers be used when moving off from rest or when changing lane. This causes the quota of 250,000 switching operations as guaranteed for the standard relay to be reached and exceeded within a very short time, so leading to turn-signal system failure. The standard small relays are designed basically to take ohmic loads, and when taking loads imposed by lamps the service life is not determined by contact erosion, as is the case with ohmic loads, but rather by the appearance of peaks due to transfer of contact material.

Remedy

For the load imposed by lamps in buses, of 4 x 21 W / 24 V, the 100 W relay

0 332 014 201 - with mounting bracket
202 - without mounting bracket

is therefore intended specially.

For high stresses due to frequent activation of the turn-signal system, we recommend the use of this relay according to the wiring diagram (Fig. 1 and Fig. 2).
For buses, the circuit in Fig. 2, together with the hazard warning and turn signal flasher 0 335 215 130 (0 336 402 012 up to 1970), is prescribed. The fuses can be replaced by thermomagnetic cutouts (e.g. ETA 3208). Supplier:

Ellenberger & Poensgen GmbH
8503 Altdorf bei Nürnberg
Industriestrasse 4 - 8

The use of thermal cutouts (e.g. ETA 5208) with vehicular hazard warning and turn signal flashers, as was previously usual in public transport corporation buses, is no longer permissible, because they are too slow to operate and therefore do not represent satisfactory fuse protection.

Please address inquiries to your authorized representative.

ROBERT BOSCH GMBH
Geschäftsbereich KH
Kundendienst - Technik

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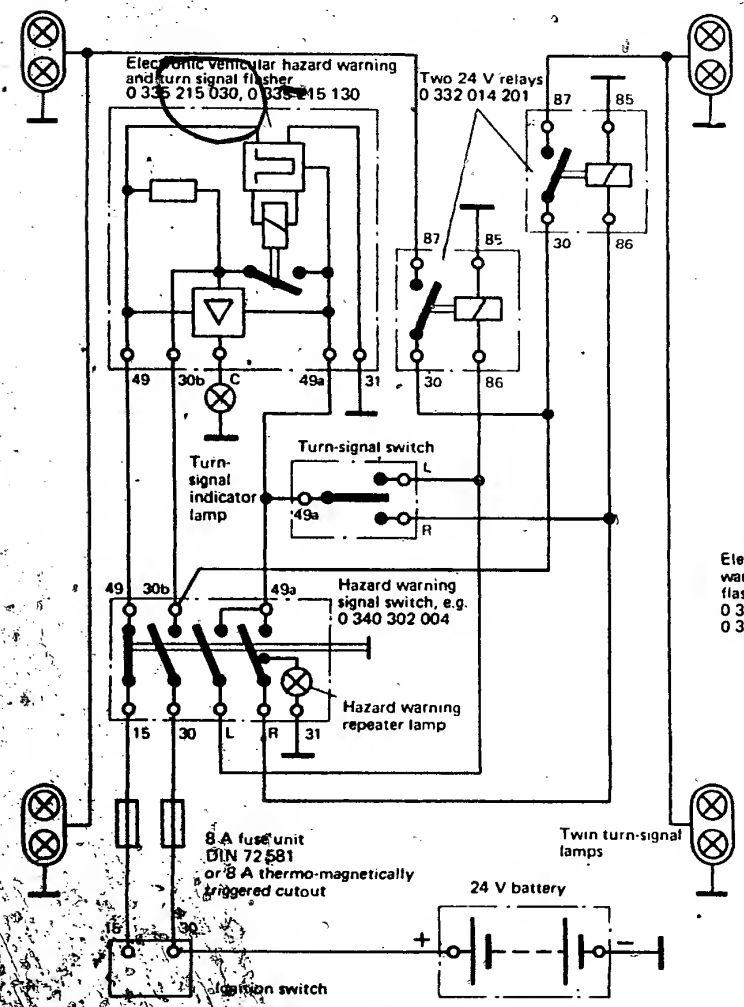
Electronic vehicular hazard warning and turn signal flasher
0 335 215 030, 0 335 215 130
Two 24 V relays
0 332 014 201
87
85
30
86
49
30b
C
49a
31
Turn-signal indicator lamp
Turn-signal switch
L
R
Hazard warning signal switch, e.g.
0 340 302 004
15
L
Hazard warning repeater lamp
8 A fuse unit
DIN 72 581
or 8 A thermo-magnetically triggered cutout
Twin turn-signal lamps
24 V battery
+
–
Ignition switch

Fig. 1

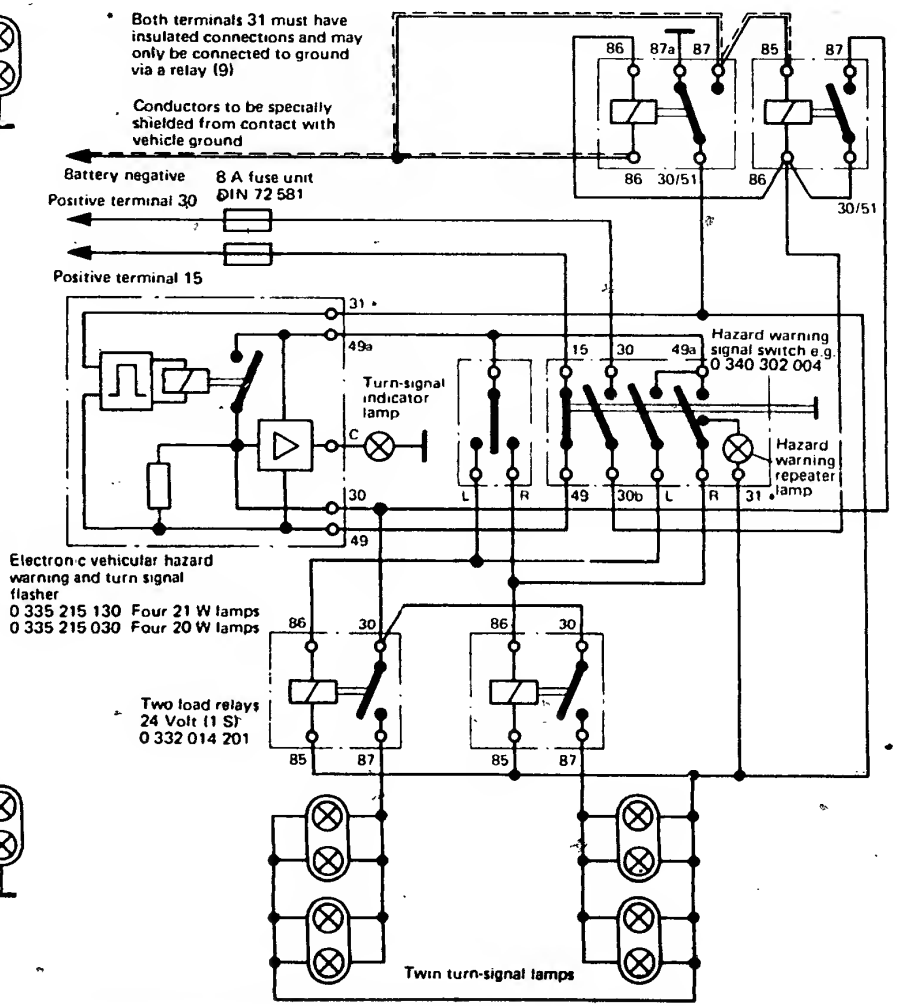
Both terminals 31 must have insulated connections and may only be connected to ground via a relay (9)
Conductors to be specially shielded from contact with vehicle ground
Battery negative
8 A fuse unit
DIN 72 581
Positive terminal 30
Positive terminal 15
86
87a
87
85
30/51
31
49a
Turn-signal indicator lamp
C
30
49
Hazard warning signal switch e.g.
0 340 302 004
15
L
R
49
30b
Hazard warning repeater lamp
Electronic vehicular hazard warning and turn signal flasher
0 335 215 130 Four 21 W lamps
0 335 215 030 Four 20 W lamps
Two load relays
24 Volt (1 S)
0 332 014 201
Twin turn-signal lamps

Fig. 2

CAR ALARM PLUS 4 (ULTRASONIC)
0 986 335 003

VDT-I-335/112 En
7. 1983

General information

Operating principle:

Ultrasound is mechanical vibrations above the frequency range of the human ear. The sensor generates ultrasonic waves which are subject to lobar propagation and thus scan the interior of the vehicle, building up an ultrasonic field. As soon as the ultrasonic field undergoes a change this is evaluated by the receiver and the alarm is triggered. Ultrasonic waves do not pass through walls or glass and are thus confined to the interior.

Application:

Optimum effect is achieved in passenger car interiors. In larger spaces (station wagon, motor home) there is such a drop in sensitivity that complete protection of the interior is no longer guaranteed. It is not possible to equip a larger space with two sensors in order to improve sensitivity. The sensors interfere with each other and trigger a false alarm. Two separate compartments can each be equipped with an ultrasonic system by using a basic system (car alarm 1 or car alarm 2).

Installation:

Smooth, hard surfaces such as windows, doors, leather covers reflect ultrasonic waves. The sensitivity is not thereby adversely affected.

Fabrics, plush, velvet, curtains absorb ultrasonic waves. This reduces the sensitivity.

Temperature fluctuations/direct sunlight do not lead to a false alarm.

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Optimum effect of the sensor is obtained if the installation location is as high as possible so that the ultrasonic waves can radiate freely.

After the system has been installed the sensitivity can be set at the alarm relay of the Plus 4 system.

See the installation instructions for further details.

Current consumption:

Car alarm Plus 4 in conjunction with car alarm 1 or 2: approx. 21 mA.

Please direct questions and comments concerning the contents to our authorized representative in yoúr country.

CAR ALARM PLUS 3 (wheel protection)
CAR ALARM PLUS 4 (passenger-compartment protection)

VDT-I-335/113 En
5.1985

The leads from angle sensor and ultrasonic detector to the respective evaluation electronics may have a mutual effect on each other. Therefore, to prevent false alarms, they should not be laid together in the same wiring harness, but should be at least 100 mm apart.

For the same reason, it is also practical to keep these leads as short as possible.

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Technical Bulletin

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ACCIDENT DUE TO EXPLODING BATTERY

VDT-I-180/107 En

0 180 ..

4.1983

As a fault of the person involved and due to unprofessional handling, a serious accident arose whilst a starter battery was being fitted into a truck.

The driver, who was fitting the battery, suffered serious injuries to his face and will probably lose his eyesight.

Reconstructed sequence of events leading to the accident

With the battery cable disconnected and with the cell cap removed, the battery was charged in the cab of the vehicle. After charging the driver reconnected the terminals and tightened first of all the negative terminal with an adjustable open-end wrench. As he was tightening the positive terminal, the wrench slipped off the hexagon nut and came into contact with the ground connection (short circuit). The resulting spark formation caused an oxyhydrogen gas explosion. Flying splinters and sprayed acid hit the driver in his face and eyes.

This careless handling of batteries leads us to point out, once again, the following:

When a battery is charged, a dangerous explosive mixture of hydrogen and oxygen is formed (oxyhydrogen gas).
Battery rooms should therefore be well ventilated. Never work with a naked flame, create sparks or smoke near a battery or in a battery room. Remove the cell cap when the battery is being charged. Observe the installation instructions.

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When fitting the battery connect first the positive cable, then the negative cable (in vehicles with negative to ground). When removing the battery, proceed in the opposite order (first negative, then positive). In this way the formation of sparks between the positive terminal and vehicle ground can be avoided when fitting the battery.

Always wear protective goggles when working on batteries.
Acid sprayed onto the skin or clothes should be washed off immediately with a lot of water.

Please inform your customers, e.g. filling stations, firms with vehicle fleets, vehicle representations and private customers about the procedure with batteries.

DANGERS FOR ELECTRONIC EQUIPMENT WHEN FAST-CHARGERS ARE USED

VDT-I-Gen. 040 En
7.1981

The results of recent investigations have led us to point out that damage to electrical components in the vehicle cannot be excluded when batteries are fast-charged or when starting-aids are used.
In particular, the control units for Motronic and ABS and the trigger boxes of transistorized ignition systems are most subjected to this danger.

To avoid damage to electrical apparatus the following instructions must be followed at all costs:

1. Do not use a fast-charger for starting the engine.
   Starting aids should only be carried out with a second 12 V battery and a starting aid cable.

   Please note: On account of the non-uniform demands placed by vehicle manufacturers on electronic products, we recommend that 24 V batteries are not to be used as a starting aid. Follow the operating instructions with the vehicle.

2. Disconnect the battery from the vehicle electrical system before fast-charging.

3. Never disconnect the battery from the vehicle electrical system with the engine running.

4. After fast-charging, tighten properly the terminals on the terminal posts of the battery.

5. When the battery is charged in the vehicle or when starting aids are used, follow the instructions with the fast-charger as well as the instructions of the vehicle manufacturer.

The main cause of the damage to electrical components are high-energy voltage peaks which are brought about by switching procedures and by unintentionally incorrect operation.
The danger increases with an increasingly sulphated battery, since the attenuating effect of the battery decreases.

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Testing the battery and starting system in the vehicle

VDT-I-Gen. 015 En
9. 1978

1. Necessary test equipment

Syringe hydrometer		MSH 3	7 781 999 404
Battery automatic-tester		T 12 600 E	7 780 500 003
Battery tester		T 12 220	7 780 500 007
Battery tester		MZP 5	7 781 999 402
Voltmeter	e.g.	EFAW 226	0 681 120 800
Ohmmeter		commercially available	

2. Trouble-shooting program

2.1 Aim of the trouble-shooting program

This program is to help workshop employees in locating the causes of trouble in motor-vehicle starting systems with the aid of suitable test equipment.

2.2 Test sequence

The test steps shown on the left in the trouble-shooting program contain test instructions and test values. Where deviations occur the appropriate rapair instructions are given in the box on the right.

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Testing the battery

Electrolyte level at least 5 mm above the electrodes or the separators.

In order?

no → Pour in distilled water up to the mark or up to 5 mm over the electrodes.

yes ↓

Test electrolyte density
Minimum density 1.26 g/cm³

In order?

no → 1. Charge the battery.
2. Check the regulator voltage (Service Information VDT-I-Gen. 013-En). Replace defective battery.

yes ↓

Test battery with (automatic) tester or check voltage under load with battery tester (min. 9.5 V).

In order?

no → 1. Charge the battery.
2. Check the regulator voltage (Service Information VDT-I-Gen. 013-En). Replace defective battery.

Testing the starter

Test requirement: battery must be sufficiently charged. See section "Testing the battery".

Starter cranks the engine thoroughly

Is the sound normal?

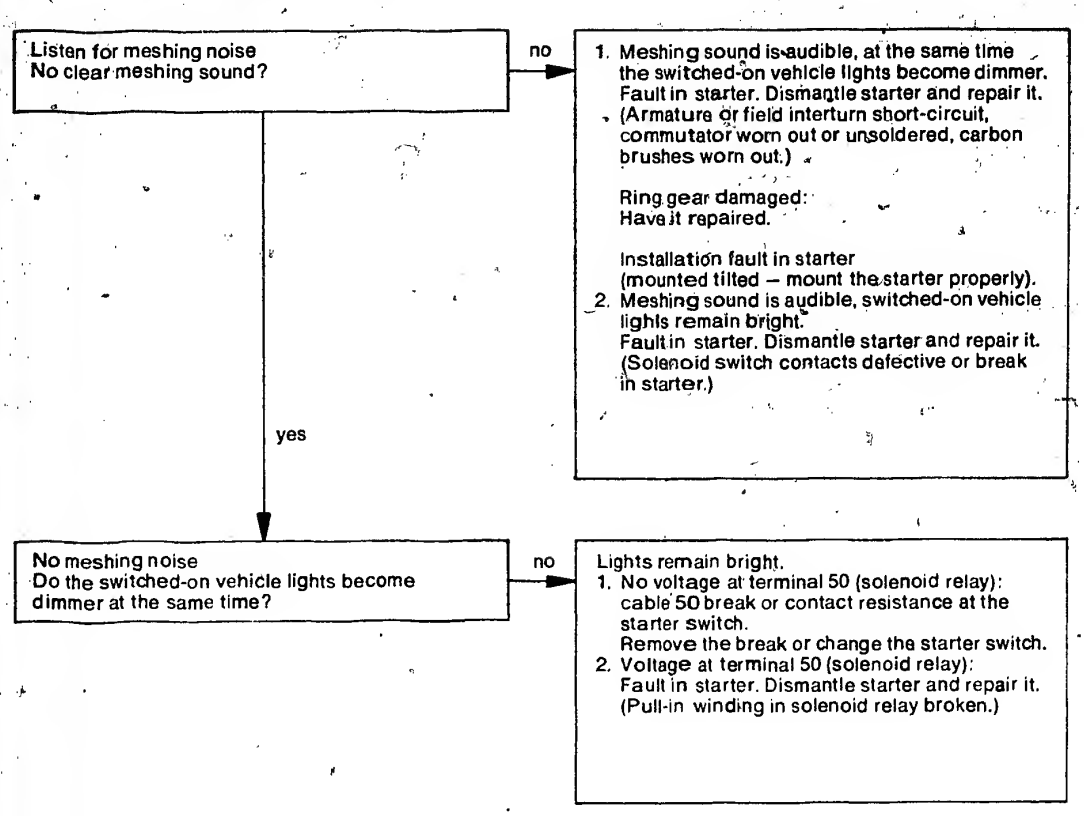
no → If the starter sound is not normal
1. Ring gear of the engine damaged
   Have it repaired.
2. Faults in the starter. Dismantle the starter and repair it (pinion, free-wheel, shift lever).

yes ↓

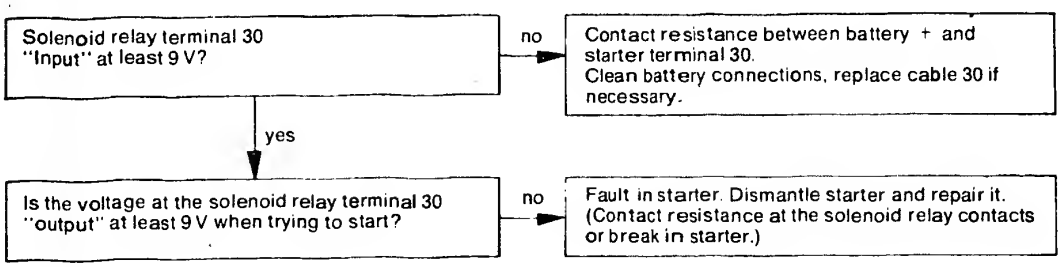
Does the engine start immediately?

no → Engine does not start immediately, when cold not at all
1 Check to see if there is an engine defect: ignition, carburettor, tappet clearance, compression.
2 If the starter has a terminal 15 a (16) check whether or not cable 15 a to the ignition coil has a break
3 In systems with a voltage increase relay check the starter without terminal 15 a (16) to see if it switches (fig. 2). In addition check relay with cable for continuity
a) relay winding with instrument lead and earth connection.
b) cable 15 from start or start ignition switch over the relay contact to ignition coil terminal 15.
Change defective relay or cable

Starter does not crank the engine



Starter cranks too slowly



Engine is running, starter switch is released, the starter must quickly demesh and come to a stand.

Starter does not demesh

Test voltage at terminal 50 (with test lamp): when the start or start-ignition switch is released terminal 50 at the starter must be free of voltage. In order?	no	Voltage at starter terminal 50: start or start-ignition switch clings momentarily, contacts glued, burnt or mechanically jammed. Change the starter switch. Short circuit between the instrument leads of the starter terminals 30 and 50. Repair the cables or replace them.

Starter demeshes very slowly

Is there still voltage at terminal 50 or at the terminal stud of the solenoid relay for the main power connection of the starter when the start or start-ignition switch is released?	no	No voltage at starter terminal 50 or at the terminal stud. Fault in starter. Dismantle starter and repair it (no armature brake effect).

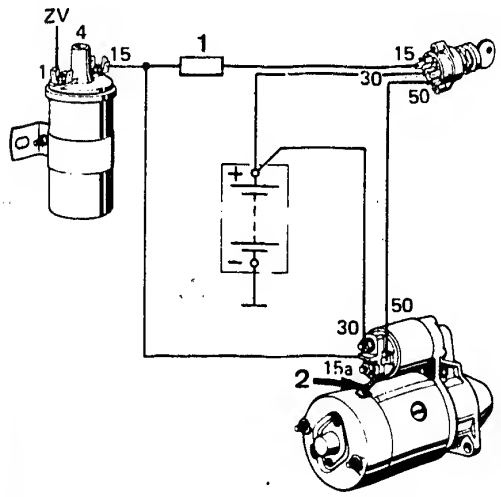


Fig 1

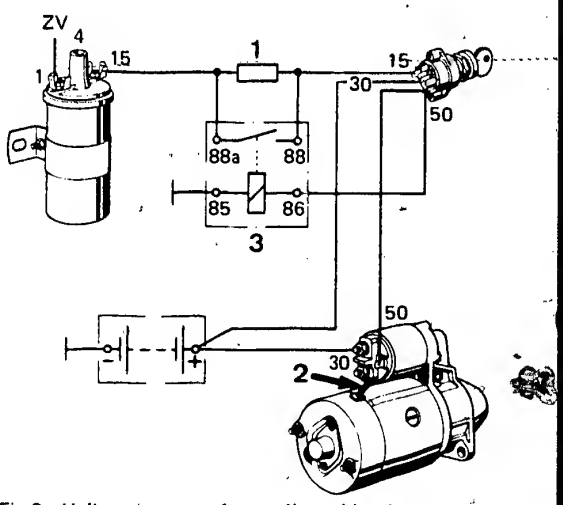


Fig 2 Voltage increase for starting with relay

1 = ballast resistor or
ballast resistor cable
2 = output terminal 30
3 = relay

ELECTRONIC START-LOCKING RELAY

0 331 801 300

Testing in the vehicle

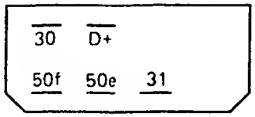
Necessary test equipment

multimeter
1 test lamp 24 V, 2 W

In this test the voltages are measured at the terminals of the fitted start-locking relay.
All measurements are referred to terminal 31 (ground).

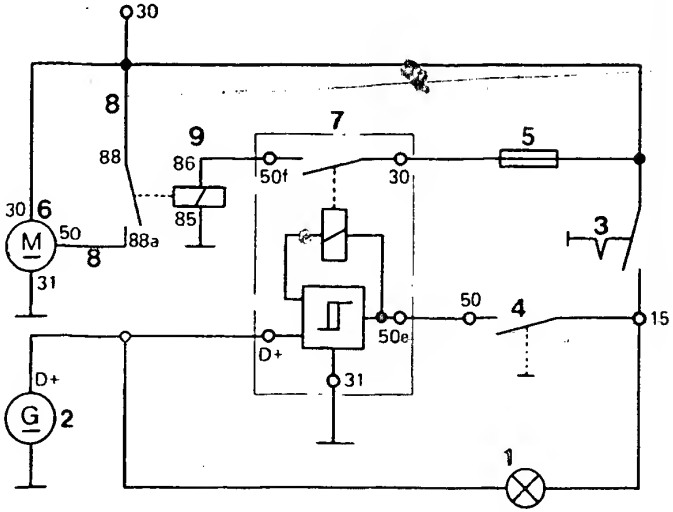
Terminal identification

Top view of the start-locking relay plug



Wiring diagram with auxiliary relay

1 Charge indicator lamp
2 Alternator
3 Driving switch
4 Starting switch
5 Fuse
6 Starting motor
7 Start-locking relay
8 Please note cable cross section
9 Auxiliary relay



Test table

Measure voltage at terminal	Necessary operation in vehicle	To be measured	If test step has negative result then...
30		Battery voltage	Fuse 5 defective
50e	Starting	Battery voltage	Driving switch, starting switch defective or open circuit up to terminal 50
50f	Starting	Battery voltage via relay contact	Start-locking relay defective or fuse 5 defective
D+	Starting - engine turns	Alternator voltage	Alternator or cable defective
D+ and test lamp connected to 50f	Starting - engine turns	18-20 V at D+ Test lamp must go out at this value	Start-locking relay defective

WARM-START SYSTEM FOR MOTOR VEHICLE ENGINES WITH WATER COOLING

VDT-I-Gen. 054 En
7. 1983

After-sales service procedure

Description of the system

Instead of a frost plug a heating element is permanently inserted into the engine block, as a result of which the coolant can be preheated. For engines with over 6 liters coolant capacity there is a heating element with reservoir which is inserted parallel to the coolant system. Connection is by means of a special cable on a 220 V grounding-contact-type socket.

The connection to the heating element is by means of an armored cable with special socket which is likewise permanently installed in the vehicle. 2-3 hours are enough to heat the coolant. A time switch for preselecting the on-time of the system is available as an accessory.

Users

The warm-start system is designed for retrofitting. Different heating elements permit the system to be used and installed in a large number of current vehicle engines.
Appropriate information is contained in offer sheet VDT-V 1/96.

Components

Heating element	9 030 250 ...	(depending on engine type)
Armored cable with socket	9 030 255 002	
Extension 70 cm	... 006	(if required)
or 30 cm	... 008	
Connecting cable 2.5 m	9 030.255 001	
or 5.0 m	... 007	
Time switch (optional)	9 025 253 035	

Service parts

It is not possible to repair the components. They are available separately as service parts.

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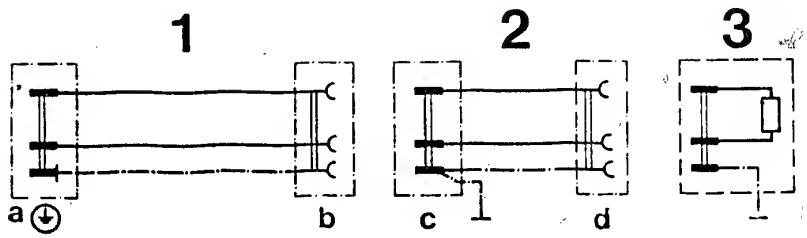
Technical documentation

Installation instructions are enclosed with the components of the system.

Test concept



1 = Special connecting cable
a = Grounding-contact-type plug
b = 3-pin socket
2 = Armored cable
c = 3-pin plug
d = Mini socket
3 = Heating element

Test the individual components for continuity and insulation in accordance with VDE standard.
Resistance values of heating elements: 500 W approx. 100 Ω
750 W approx. 75 Ω

Note:

The protective conductor connection is in the 3-pin socket of the armored cable via a fastening screw to vehicle ground as well as in the heating element (upper pin between locating lugs) to the engine block. The metal-hose sheathing of the armored cable as well as of the extension cable must be grounded through the vehicle chassis using the enclosed metal hose clamp.

When performing installation and repair work, make sure that these parts make proper contact with the vehicle chassis!

The armored cables and extension cables supplied before June 1983 were provided with hose clamps made of plastic. In the interest of safety these should be replaced by metal hose clamps. This should also be done wherever it is possible to contact vehicle owners who have had the warm-start system installed.

Check the cable packs in your stores and send for the required number of metal hose clamps for the conversion to:

Robert Bosch GmbH
Abtlg. KH/QSG
Postfach 41 09 60
7500 Karlsruhe 1

Defective components must always be replaced. Repair is not allowed.
In the case of complaints remember that there may be a fault in the customer's power supply or in his wall socket.

System training

Is not required.

Warranty procedure

Components of the system are treated in the same manner as electrical vehicle body equipment (warranty period 12 months).

Burnt-out heating elements point to the absence of coolant or incorrect bleeding of the cooling system after installation. In this case, the warranty claim must be rejected.

Please direct questions and comments concerning the contents to our authorized representative in your country.

WARM-START SYSTEM FOR MOTOR VEHICLE ENGINES WITH WATER COOLING

VDT-I-Gen. 054 En
Suppl. 1
11.1983

Fitting armored cable 9 030 255 002

In order to establish a perfectly protected connection with vehicle ground, the 3-pin socket of the armored cable must be fastened to the vehicle with fillister-head screws, whereby tooth-lock washers must always be laid between the socket and the bodywork.

If, on account of unfavorable fitting conditions, self-tapping screws must be used instead of fillister-head screws, then a ground connection must be made between the grounded fastening hole of the socket and the second screw (metal strip or cable with holes).

Vehicles already fitted with this ground connection should be checked to make sure that the connection has been made properly.

> When repairs and adjustments are carried out, please see that these parts do in fact make perfect contact with the vehicle ground.

Please also note

Automotive electric service centers, which do not employ an electrician, can fit the warm-start system providing the annual amount for such extra work (manpower and material) does not exceed DM 36,500.

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VDT-I 265/102 En

1.1986

supersedes edition 7.1984

NO REPAIRS PERMITTED/ MAXIMUM ALLOWABLE SHELF LIFE FOR ABS HYDRAULIC MODULATORS

1. No repairs permitted

The passenger-car ABS is a piece of safety equipment. As a result of unauthorized interference with the ABS components there is the danger that the efficient operation of the ABS system will be adversely affected.

We would point out, therefore, that the hydraulic modulator must under no circumstances be repaired. For safety reasons it must be exchanged as a complete unit.

It is only permitted to exchange the motor and valve relays. All other screws and plugs must not be loosened.

2. Maximum allowable shelf life

The maximum allowable shelf life for hydraulic modulators is 5 years, reckoned from the production date (FD) given on the product.

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The following storage conditions must be met:

- Hydraulic modulator filled with brake fluid (is supplied filled by Bosch).
- Vertical / upright position (cover at top).
- Ambient temperature between - 20°C and + 50° C.
- Dry storage.

After 5 years storage time it is necessary to replace all rubber and plastic components and the hydraulic modulator must be subjected to a functional check.

The replacement of the rubber and plastic components as well as the functional check can be performed at the factory only. Once checked, the hydraulic modulators are identified with L and new FD.

Service centers in the Federal Republic of Germany should send the hydraulic modulators to:

Robert Bosch GmbH, Abt. K1/VAK 2,
Robert-Bosch-Straße, 7141 Schwieberdingen

Service centers in other countries should send the hydraulic modulators to:

Robert Bosch GmbH, KH/LAV 2 - Auspackraum,
z.W. an K1/VAK 2, Auf der Breit 4, D-7500 Karlsruhe 41

The hydraulic modulators should be sent in to us postage-paid. On the enclosed delivery note please quote this Technical Bulletin.

The replacement of the components and the functional check are performed subject to payment.

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New Product

0 460 4 . .
Distributor-type fuel injection pump VE ., F ..

VDT-I-460/1 B
Ed. 1
11. 1975
Translation of
German edition
of 9. 1975

The description is given of a novel Bosch distributor-type fuel injection pump.

In this pump (high-pressure pump) supply pump, governor and timing device are combined.

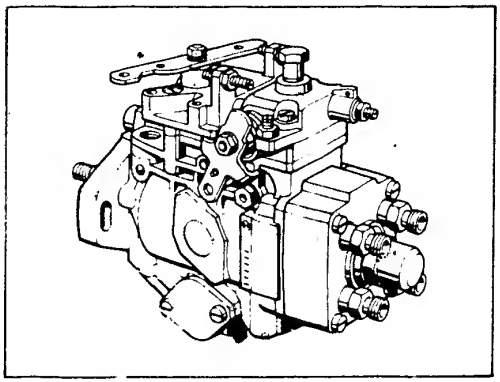

Fig. 1

Features and characteristics

This distributor-type fuel injection pump differs from the EP/VA fuel injection pump mainly in the control system.

The particular features and characteristics are:

- Mechanical governor, which is driven through gears from the pump drive.
- Largely unaffected by temperature and viscosity.
- Hydraulic head and governor separated, thus fewer types of hydraulic head (facilitates servicing).
- Can be fitted with a wide range of accessories for control of the full-load delivery as a function of
  – charge-air pressure
  – atmospheric pressure
  – temperature
- Hydraulic and mechanical correction of fuel delivery (positive and negative torque control).
- Choice of variable-speed governing or maximum-minimum-speed governing. Combination of both systems also possible.
- Permits easier adaptation to engine to achieve an optimum for performance, exhaust gas, consumption, torque, etc.
- Adjustment of start of injection dependent on load and rotational speed.
- Governor parts manufactured by non-cutting method.

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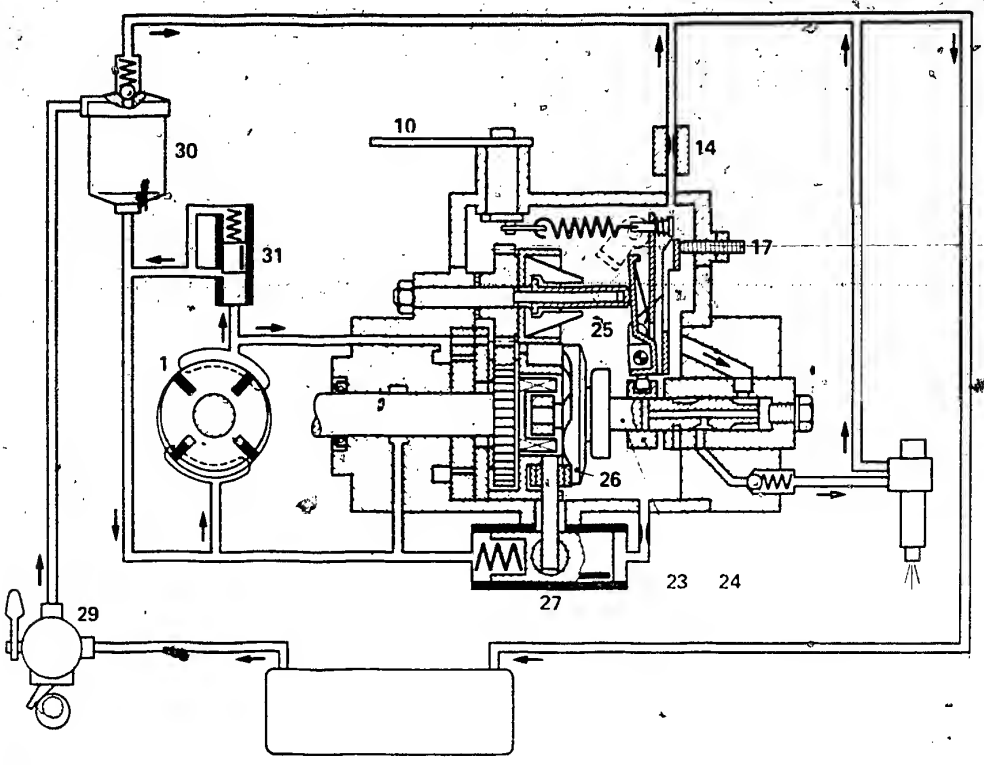


Fig. 2

Legend for Figs. 2 and 3

1 = Vane supply pump
2 = Drive shaft
3 = Gear wheel
4 = Pressure disc
5 = Governor spindle
6 = Sliding sleeve
7 = Governor cage
8 = Flyweights
9 = Governor spring
10 = Control lever
11 = Adjustment screw (idle)
12 = Adjustment screw (rated speed)
13 = Stop lever
14 = Excess-flow valve
15 = Correction lever
16 = Retaining pin
17 = Adjustment screw (full load)
18 = Idle spring
19 = Tensioning lever
20 = Starting spring
21 = Starting lever
22 = Outlets
23 = Distributor-pump plunger
24 = Regulating collar
25 = Pump interior
26 = Cam plate
27 = Timing-device piston
28 = Cam roller ring
29 = Pre-supply pump
30 = Fine filter
31 = Pressure-regulating valve

Construction and operation

1. Fuel circuit and circulation (Fig. 2)

The fuel is drawn from the tank by the pre-supply pump (29) and conveyed via a fine filter (30) to the vane supply pump (1). The vane supply pump supplies a constant quantity per revolution, and produces pressure via the pressure-regulating valve (31). The majority of the fuel conveyed flows through the pressure-regulating valve back again to the suction side. The remainder flows through the pump interior (25) to be conveyed into the high-pressure chamber of the hydraulic head or flows through the excess-flow valve (14) back to the tank for cooling and removal of air.

The distributor-pump plunger (23) is actuated by the drive shaft (2). The cam plate (26) and rollers in the cam roller ring (28) cause a stroke movement to be imparted in addition to the rotary movement.

The stroke produces feed at high pressure and the distribution of the injected quantity to the individual outlets (22) is made through a metering slit in the distributor-pump plunger.

The port opening is controlled by the regulating collar (24) opening the spill ports in the pump plunger. The fuel flows back into the pump interior (25).

The mechanical governor controls the regulating plunger (24).

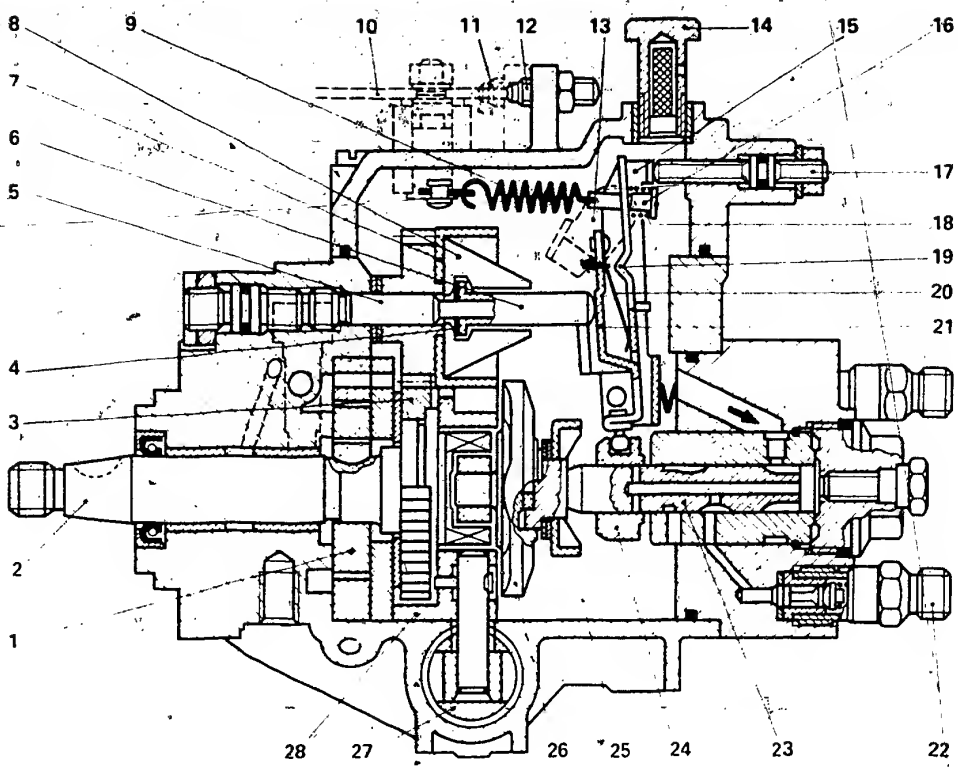


Fig. 3

2. Construction of mechanical governor (Fig. 3)

The mechanical governor is fitted on the upper side of the distributor pump.

The governor cage (7) with gear wheel is fixed on the governor spindle (5) and driven by the drive shaft (2) through a rubber buffer (vibration damper)

Four flyweights (8) are arranged in the flyweight cage and their pressure arms press through a pressure disc onto the axially-movable sliding sleeve (6). The regulating-lever group consists of starting lever (21), tensioning lever (19) and correction lever (15) The starting lever and tensioning lever pivot in the correction lever, which pivots in the pump housing. An adjustment of the full-load delivery with adjustment screw (17) is thereby possible without at the same time affecting the rotational-speed control.

The starting lever (21) carries a leaf spring, which serves as starting spring (20). An axially-movable retaining pin (16) with idle spring (18) at the top end of the tensioning lever (19) is suspended in the governor spring (9) The tension of the governor spring can be changed by turning the control lever (10). The starting lever (21) is provided with a spherical head on the lower end which serves to move the regulating collar (24).

3. Operation of the mechanical governor (Fig. 3)

The rotational speed of the engine is transferred by the drive shaft (2) through gears to the flyweights (8) and here converted into a centrifugal force.

When the distributor pump is not working, the starting lever (21) and the regulating collar (24) are pressed by the starting spring (20) into start position. The full starting delivery is thus automatically obtained on starting

When the engine is run up to speed after starting, the sliding sleeve (6) overcomes the weak force of the starting spring (20), the starting lever (21) pushes up against the tensioning lever (19) and the starting delivery is automatically stopped by movement of the regulating plunger.

At the lower idle speed the governor spring (9) is ineffective and control is taken over by the idle spring (18)

A lower or higher breakaway speed is set depending on the tension the control lever (10) has imparted to the governor spring (9) The force of the idle spring is overcome

The idle delivery is set by adjustment screw (11), the full-load delivery by adjustment screw (17).

The upper rated speed is set by adjustment screw (12)

The injection pump can be stopped electrically with an electromagnet (e.g. on the Opel) or mechanically with a stop lever (13).

When an electromagnet is used to stop the pump, the inlet port to the high-pressure chamber of the hydraulic head is closed; the electromagnet is made currentless for this purpose.

When the pump is stopped mechanically, the start lever (21) is so shifted, by an outer and an inner stop lever (13), that the regulating collar takes up a position which does not allow the spill ports to close at all.

4. Injection control (Fig. 3)

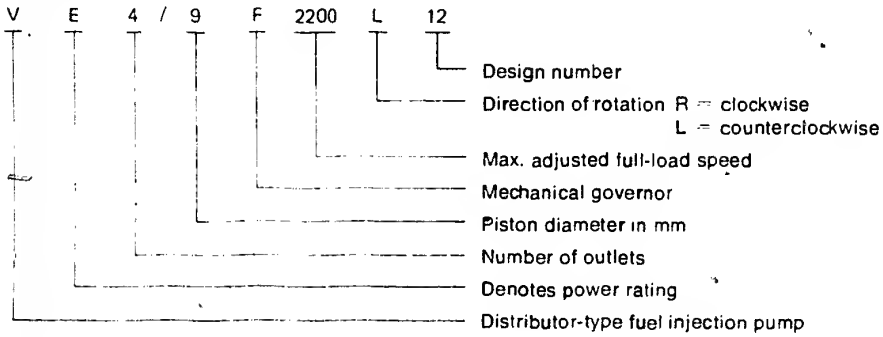
The spring-loaded timing device piston (27) is located on the underneath of the distributor pump across the axis of the pump. Depending on the supply-pump pressure, the cam roller ring (28) is turned through an adjustment mechanism and the start of injection is thus set according to the rotational speed.

If desired, a load-dependent control of the timing device can be incorporated whereby the pressure in the pump interior can be altered by a by-pass bore (in the sliding sleeve, 6) to the supply-pump suction chamber (as on the Opel).

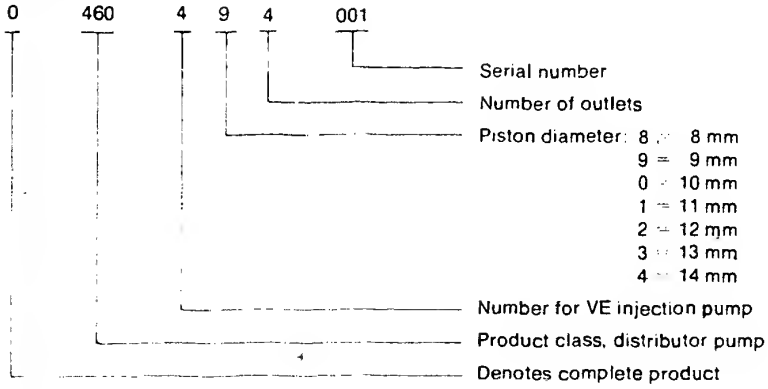
5. Customer service note

The usual customer service is provided for these distributor pumps. Technical workshop documentation as well as test equipment and repair tools are available.

Elucidation of pump code



Key to part number



Published by:

After-sales Service Training Center
Automotive Equipment (KH/VSK)

New Product

0 460 4. .
VE. . F. . with part-load governor
and cold-start accelerator

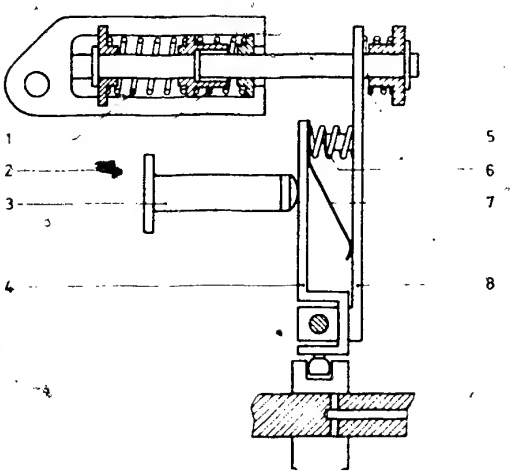
VDT-I-460/1 B
Suppl. 1
9. 1976

The operation of distributor-type fuel injection pump VE . . F . . was described in Technical Bulletin VDT-I-460/1 B.
A different version of this pump with "part-load governor" and "cold-start accelerator" has been specified and is being installed for the first time in the VW Golf and Passat models.

1. Part-load governor

In fuel-injection pumps the configurations of the intake port and spill port cross-sections give rise to certain injected fuel quantity characteristics required for the full-load curve. The result is that the injected fuel quantity increases with increasing engine speed at a constant position of the control spool.

This increasing rate-of-discharge curve is disturbing in the part-load range since the injected fuel quantity curve rises more rapidly than the fuel-requirement curve. The result is unstable governing ranges with "bucking" while driving. The performance of such a car is markedly inferior to that of a carburettor engine. The performance is again improved by using the part-load governor.



1 = Main regulating spring
2 = Part-load spring
3 = Sliding sleeve
4 = Starting lever
5 = Intermediate spring
6 = Idle spring
7 = Starting spring
8 = Tensioning lever
9 = Control spool

Construction of the governor

The part-load governor is mounted on the top of the distributor pump. The part-load governor comprises the main regulating spring and the part-load spring. The intermediate spring is fitted at the end of the guide pin. The idle spring and the starting spring are located between the starting lever and the tensioning lever.

Operation of the governor

The part-load governor has to regulate the injected fuel quantity in the part-load range such that it remains constant or decreases slightly at a constant accelerator pedal position. This is achieved by a part-load spring between the idle spring and the main regulating spring.

When the idle speed is exceeded, the path of the intermediate spring is traversed and the bushing and tensioning lever contact. The part-load spring then acts from this engine speed on. With increasing engine speed the spring is compressed by a certain amount, and the control spool is moved so much via the tensioning and starting levers that the injected fuel quantity does not increase at a constant accelerator pedal position but remains constant or even decreases slightly. Shortly before the maximum full-load engine speed is reached, the path of the part-load spring is traversed and the spring has no further effect.

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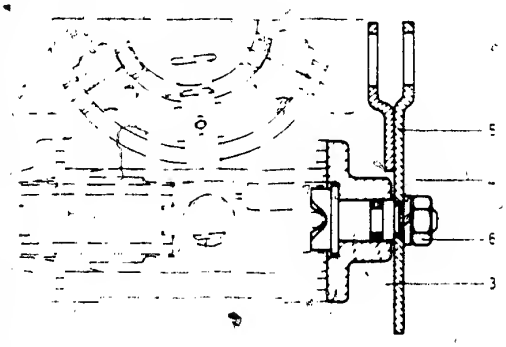
2. Cold-start accelerator

A further innovation as regards this distributor-type injection pump for VW is the cold-start accelerator.

The cold-start accelerator is mounted on the side opposite the timing device spring. It is cable-actuated from inside the vehicle. The timing device piston is provided with a 4 mm pin and is advanced by means of the stop lever and the shaft with the cam.

- Built-in cold start accelerator



1 = Cover
2 = Shaft
3 = O-ring
4 = Spring lock washer
5 = Stop lever
6 = Hexagon nut

New Product

VDT-I-460/2 En
10.1979

Distributor-type fuel-injection pump VE..F.. with temperature-controlled cold-start accelerator (KSB)
temperature-controlled idle-speed increase (TLA)
temperature-controlled limitation of starting-fuel delivery (TAS)

1. Temperature-controlled cold-start accelerator (KSB) acting on cam roller ring

The builders of passenger car engines often retard the start of injection for the engine at normal operating temperature.

This results in the engine running more smoothly and more quietly.

However, this retarding of the start of injection may lead to difficulties in starting such engines when they are cold. Furthermore, these engines tend to run roughly and to generate smoke when cold.

The cold start accelerator has been developed to counteract this. The cold start accelerator advances the start of injection when the engine is cold.

Apart from the already known, hand-operated cold start accelerator on the timing device, there is now the temperature-dependent cold start accelerator on the cam roller ring. This offers the advantage that the start of injection is automatically controlled as a function of the cooling-water temperature and false operation is impossible.

2. Temperature-controlled idle-speed increase (TLA)

When cold, every engine has increased frictional resistance due to fits, viscocity of the engine oil etc.

The cold engine does not run smoothly at the idle speed set for the warm engine.

In order to prevent this, many types of fuel-injection pump have to date been fitted with a hand-operated stop to increase the idle speed.

Apart from the hand-operated idle stop, a temperature-dependent idle stop has been developed which controls the idle speed as a function of the cooling-water temperature or the engine temperature.

3. Temperature-controlled limitation of starting-fuel delivery (TAS)

As was stated under Point 2, every engine has increased frictional resistance when cold.

This frictional resistance calls for a relatively large starting-fuel delivery when the engine is started.

If this large starting-fuel delivery is also injected for warm or hot starts, this results in a heavy generation of smoke.

This smoke can now be prevented by the temperature-dependent limitation of the starting-fuel delivery, since the starting-fuel delivery injected into the engine always corresponds to the temperature of the engine.

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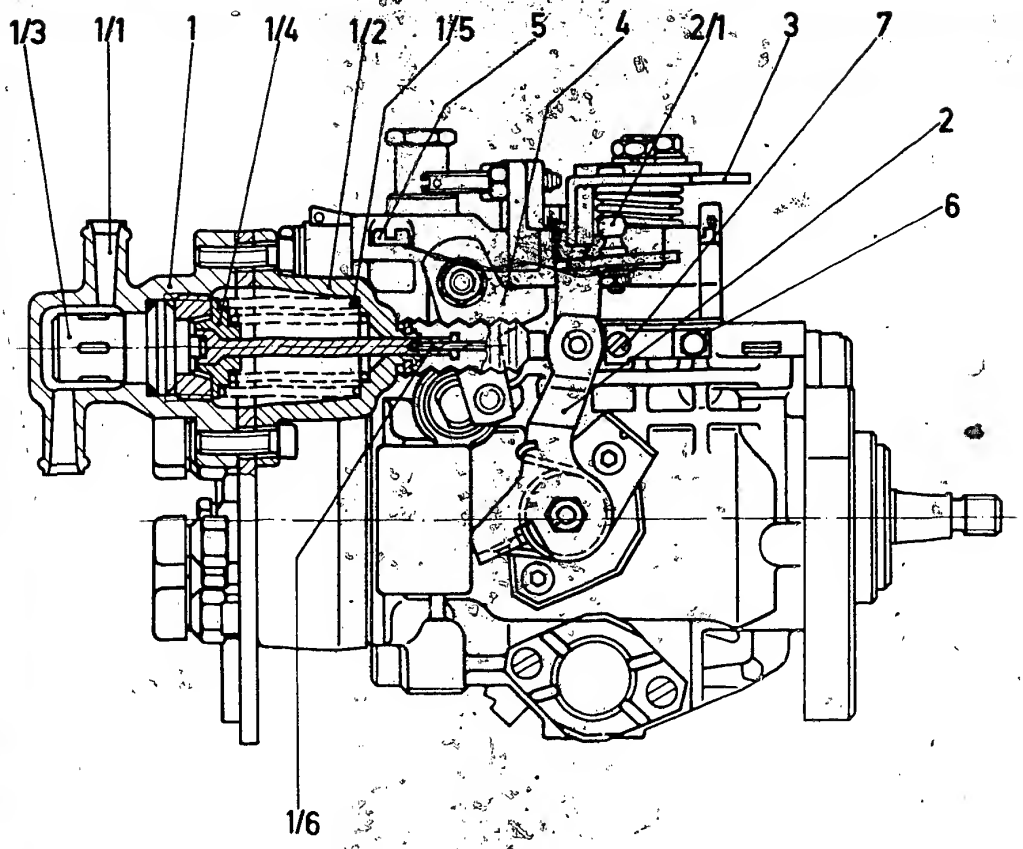


Fig. 1

1 – Control device
1/1 – Upper housing
1/2 – Lower housing
1/3 – Expansion element
1/4 – Spring seat
1/5 – Helical compression springs
1/6 – Control cable
2 – KSB control lever
2/1 – Ball stud
3 – Speed-control lever
4 – Regulating lever
5 – Stop screw
6 – Clamping piece
7 – Intermediate piece

4. Construction and operation

4.1 Construction

The temperature-dependent or temperature-controlled components are actuated by an expansion element (1/3) which is installed in the control device and is located in the engine cooling water flow. The expansion element is filled with a wax-like compound which expands when heated and actuates a pressure pin located in the expansion element.

The pressure pin changes its position depending on the temperature of the cooling water and transmits this movement via a control cable to the control lever of the KSB.

The other functions, TLA and TAS, are also controlled via the control lever of the KSB. This means that all movements of the KSB control lever are transmitted via appropriate elements to the speed-control lever of the distributor-type fuel-injection pump or to the regulating lever for limitation of the starting-fuel delivery.

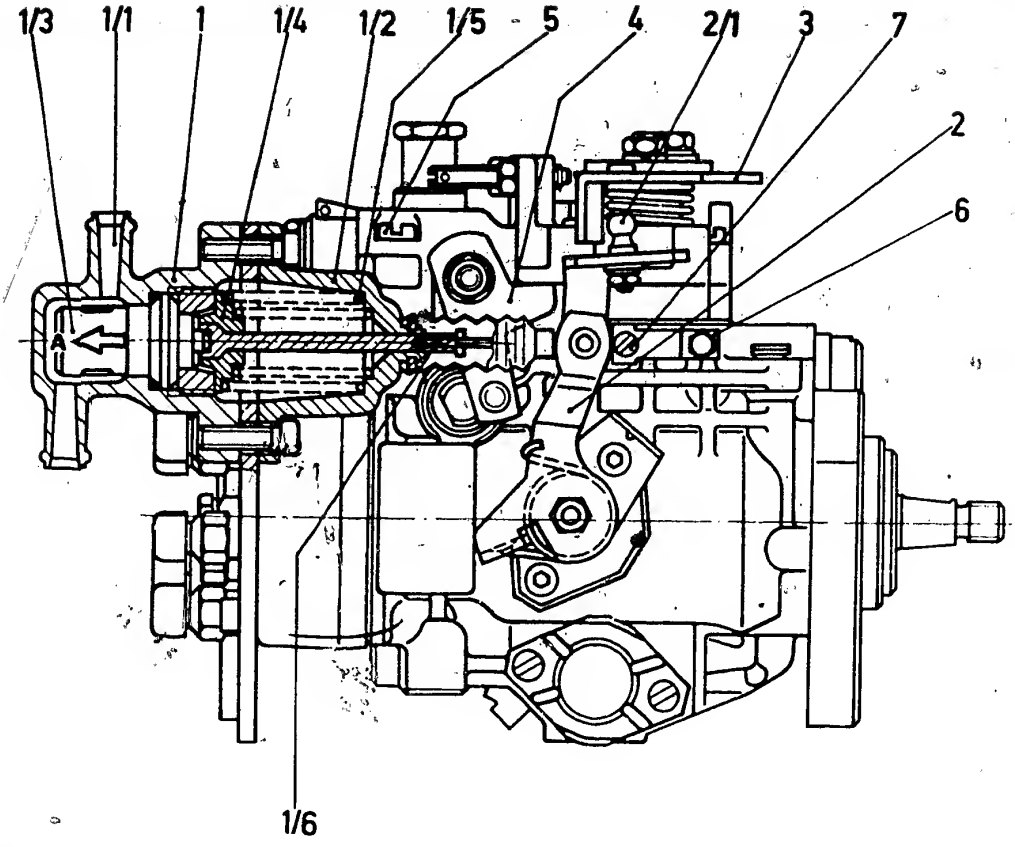


Fig. 2

1 = Control device
1/1 = Upper housing
1/2 = Lower housing
1/3 = Expansion element
1/4 = Spring seat
1/5 = Helical compression springs
1/6 = Control cable

2 = KSB control lever
2/1 = Ball stud
3 = Speed-control lever
4 = Regulating lever
5 = Stop screw
6 = Clamping piece
7 = Intermediate piece

4.2 Operation

4.2.1 Temperature-controlled cold-start accelerator (KSB)

The expansion element (1/3) is connected to the KSB control lever (2) via the spring seat (1/4) and the control cable (1/6).

If the coolant temperature of the engine drops, then the pressure pin of the expansion element moves towards **A**.

The helical compression springs (1/5) are supported on the lower housing (1/2) and the spring seat (1/4) so that the spring seat (1/4) with control cable (1/6) follows the movement of the pressure pin.

The intermediate piece (7) and the clamping piece (6) are fitted to the control cable (1/6) after the control lever (2) with the result that the control lever (2) also moves towards **A**.

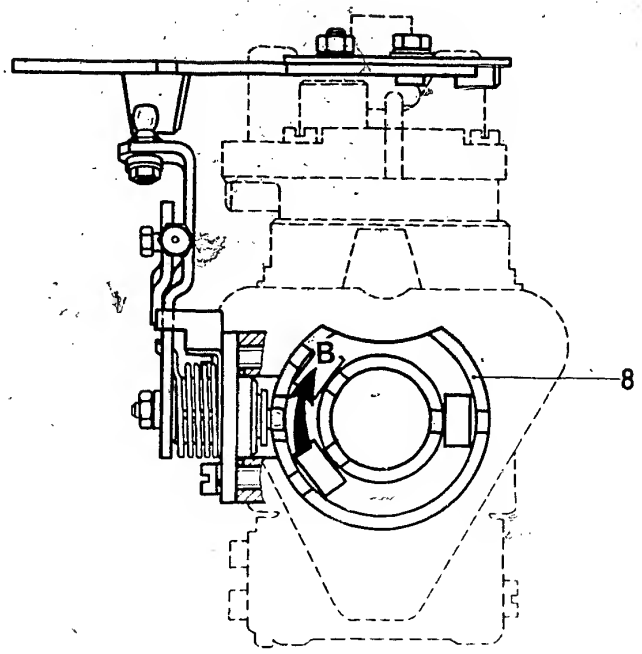


Fig. 3

8 Cam roller ring

The control lever (2) is connected to a setting shaft, on the end face of which there is an eccentrically mounted ball stud inside the pump which projects into a recess on the cam roller ring (8).

When the control lever is moved by the control device (1) or the expansion element (1/3), then this moves the cam roller ring (8).

When the control lever (2) moves towards **A**, the cam roller ring (8) is turned towards **B** via the setting shaft of the KSB.

The start of injection is thereby advanced.

As the engine (coolant) warms up, the pressure pin of the expansion element (1/3) presses against the helical compression springs (1/5).

The control lever (2) thereby returns to its starting position. The cam roller ring (8) is again moved in the direction of "retard".

4.2.2 Temperature-controlled idle-speed increase (TLA)

If the engine temperature drops (below the operating temperature), the control lever (2) is drawn in the direction of the control device (1).

When the control lever (2) has travelled a specified distance, the ball stud (2/1) comes into contact with the speed-control lever (3).

If the engine temperature drops still further, then the control lever (2) is drawn further towards the control device.
The speed-control lever (3) thereby lifts off from the idle stop. This increases the idle speed of the engine.

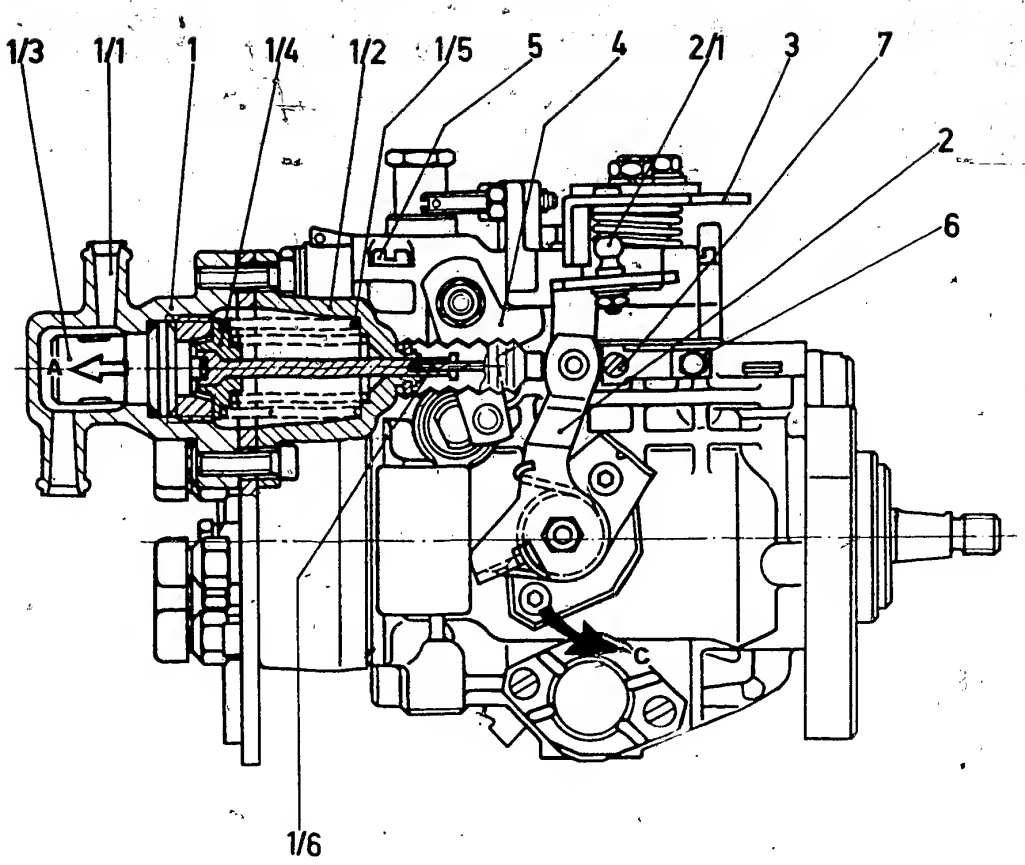


Fig. 4

1 = Control device
1/1 = Upper housing
1/2 = Lower housing
1/3 = Expansion element
1/4 = Spring seat
1/5 = Helical compression springs
1/6 = Control cable
2 = KSB control lever
2/1 = Ball stud
3 = Speed-control lever
4 = Regulating lever
5 = Stop screw
6 = Clamping piece
7 = Intermediate piece

4.2.3 Temperature-controlled limitation of starting-fuel delivery (TAS)

The regulating lever (4) is connected to the setting shaft (9) so that the setting shaft (9) follows all the rotational movements of the regulating lever in the same direction.

The end face of the setting shaft (9) is shaped in such a way that, as of a given position, it presses against the starting lever.

The regulating lever (4) is connected to the control lever (2) via a wire link.

This wire link is attached to a strap on the control lever (2).

This means that all the movements of the control lever (2) are transmitted to the regulating lever (4).

When the engine is cold, the control lever (2) has travelled its full stroke towards the control device (1).

The attachment strap on the control lever (2) swings towards **C**.

The regulating lever (4) is in its rest position, i.e. it is in contact with the fuel-injection pump cover opposite the stop screw (5).

The distributor-type fuel-injection pump delivers the maximum starting-fuel delivery for starting.

As the engine warms up, the compound in the expansion element (1/3) presses the pressure pin against the spring seat (1/4) and the helical compression springs (1/5).

The control lever (2) thereby moves towards the pump drive shaft.

The attachment strap on the control lever (2) swings in a clockwise direction, away from **C**, and presses the regulating lever (4) towards the stop screw (5).

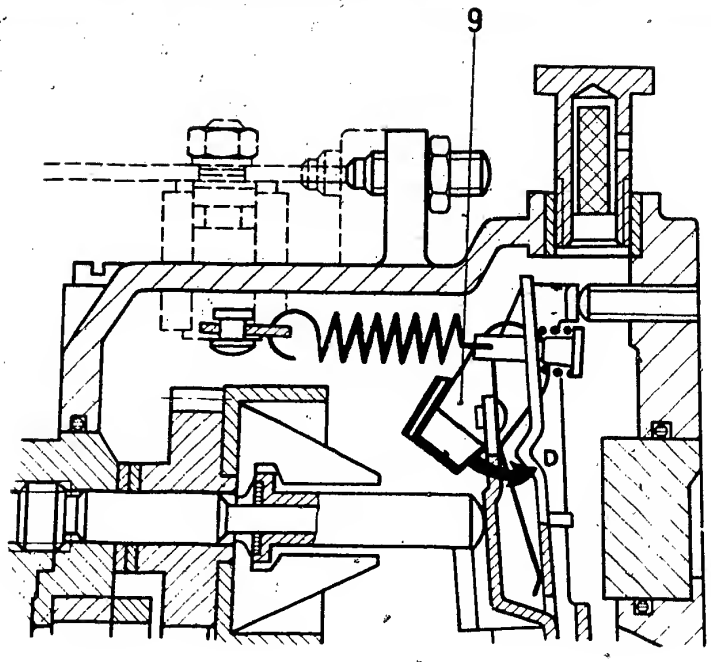


Fig. 5

9 = Setting shaft

The setting shaft (9) swings towards **D** and, after the regulating lever has travelled a given distance, contacts the starting lever of the fuel-injection pump.

As the temperature of the cooling water (engine) further increases, the starting lever is exposed to continuous pressure, thereby limiting the available starting-fuel delivery.

When the engine is at its operating temperature, the regulating lever (4) is in contact with the stop screw (5). In this position there is still a given minimum starting-fuel delivery.

New Product

VDT-I-460/3 En
10.1979

Distributor-Type Fuel-Injection Pump

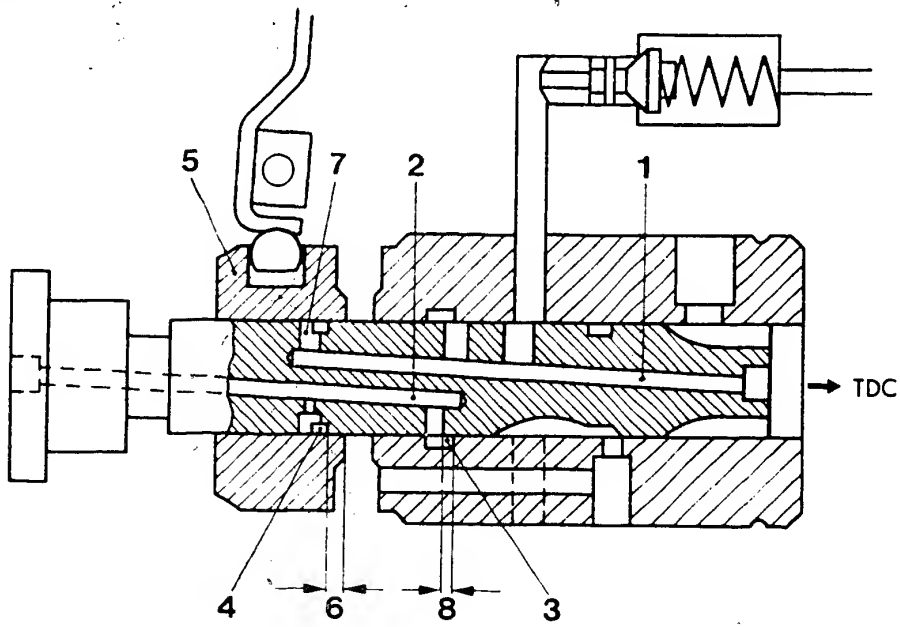
VE..F.. 0 460 4..

with quiet-idle device

The function of the VE..F.. distributor-Type fuel-injection pump is described in the Technical Bulletin VDT-I-460/1.
A model of this injection pump equipped with a quiet-idle device has now been released.

Quiet-idle device

On present-day Diesel engines, in order to improve the composition of the exhaust gas the fuel is injected into the combustion chamber in as short a time as possible, i.e. high rates of injection are used.
A high rate of injection is noticeable, depending upon system design and particularly in the idle range, in the form of idle-knock.
By increasing the duration of injection in the idle range for quieter combustion is achieved and idle-knock prevented.



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Construction and operating principle of the quiet-idle device

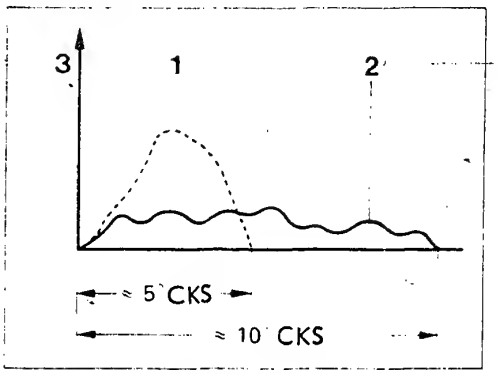
The plunger of the distributor-type fuelinjection pump with integrated quiet-idle device has 2 longitudinal bores (1) and (2) which are connected by an annular groove (3).

The longitudinal bore (2) has a spill section (4), under which there is a restriction, in the area of the control collar (5).

When the plunger moves in the direction of TDC, the spill section (4) belonging to longitudinal bore (2) leaves the control collar (5) earlier than the spill section (7) belonging to the longitudinal bore (1), that is, after plunger travel (6).

Due to the fact that the bores (1) and (2) are connected by the annular groove (3), part of the fuel leaks from the high-pressure chamber into the interior of the pump upon the spill section (4) leaving the control collar (5) before spill section (7).

The result is a reduction in the rate of injection (i.e. less fuel is injected per degree crankshaft). The same quantity of fuel is injected but spread across almost twice the number of crankshaft degrees.



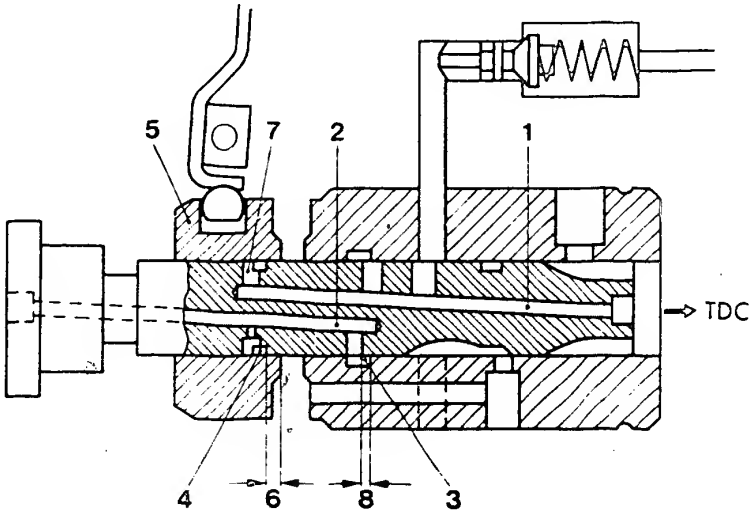
1 = Nozzle-needle lift without quiet-idle

2 = Nozzle-neddle lift quiet-idle

3 = Injected fuel quantity

In the full-load range the control collar is nearer to the hydraulic head.

This means that the distance (8) is less than the distance (6). When the plunger now moves in the TDC direction, the annular groove (3) is covered before the spill section (4) emerges from the control collar (5). In other words the connection between bore (1) and (2) no longer exists, and the result is that the quiet-idle device is ineffective in the full-load range.



Distributor-type fuel-injection pump VE . . F . .

VDT-I-460/106 En
7.1978

Modifications and notes

1. Securing and adjusting the two-piece control lever
2. New spacer sleeve for limiting full-load delivery
3. Sleeve for securing the pump cover
4. Insertion of a new seal ring (item 92)
5. New slotted shoulder screw (item 104)
6. Axial clearance of governor assembly
7. Fastening of plug, item 117 or 827 (for various versions)
8. Modified tightening torque for fastening screws (item 38) of timing device cover on spring end
9. Injection timing as per "pointer method"
10. New KDEP tools for distributor-type fuel-injection pump repairs and testing
11. Functional test of solenoid-type stop valves

The item numbers occurring in the text correspond to the service part items on micro-fiches.

1. Securing and adjusting the two-piece control lever

Various distributor-type fuel-injection pumps have recently been fitted with two-piece control levers.

After adjustment these control levers must be positively connected with one another. An appropriate KDEP tool is currently being developed for this purpose (KDEP 1107).

The previous single-piece control levers cannot be interchanged with the new two-piece control levers since the shaft has also been changed.

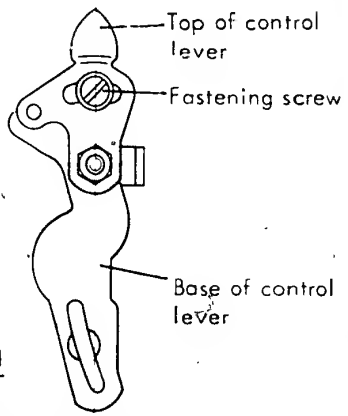


Fig. 1

Testing

For purposes of testing the distributor-type fuel-injection pump, the existing, stamped control lever is mounted such that the markings on the control lever and shaft tally.

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Then set idle delivery.
Using a vice-grip wrench clamp tool KDEP 2899 to pump clamping flange in such a manner that the distance between the pump flange and center of round stamp on control lever can be measured.

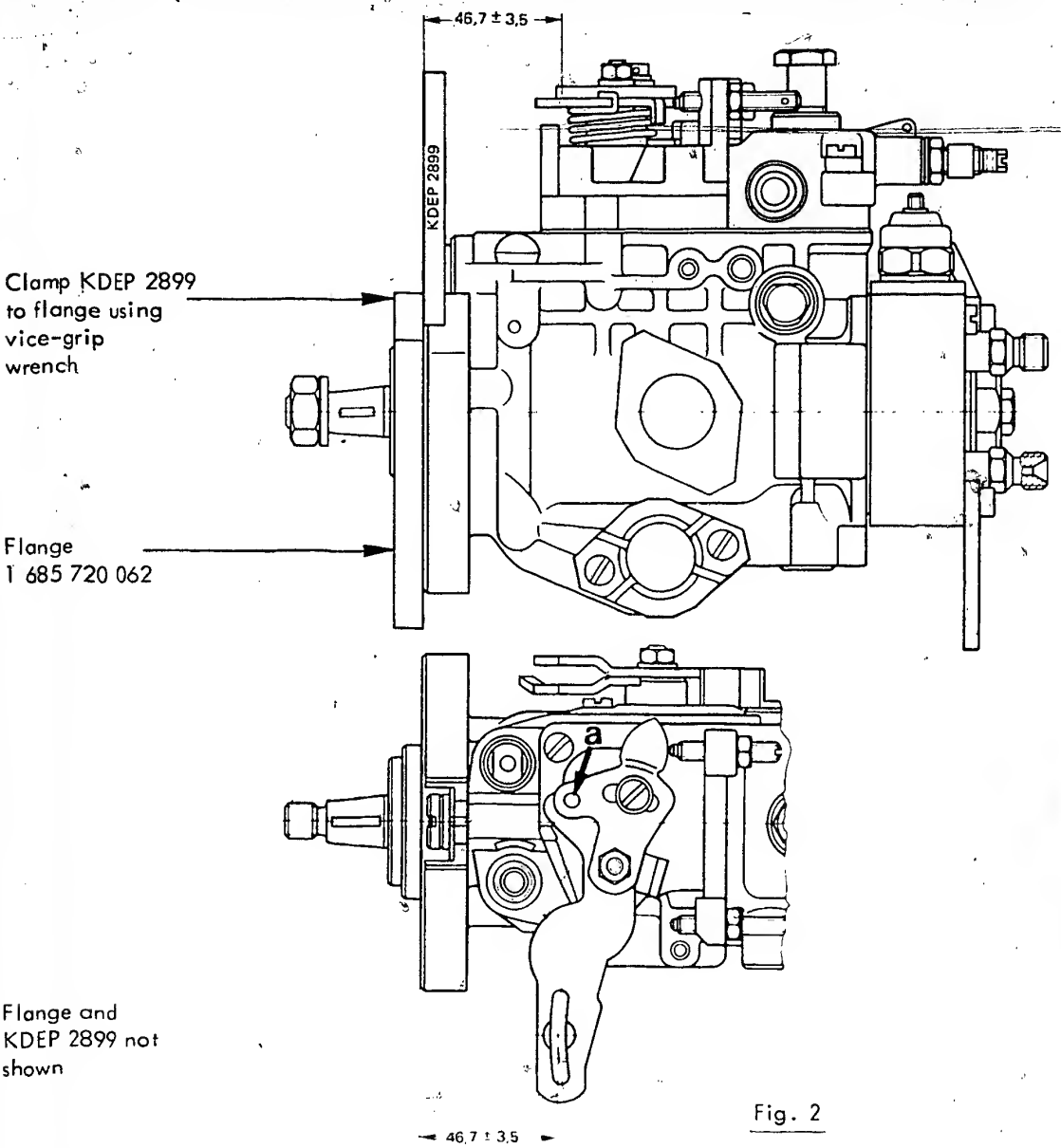

Fig. 2

Check distance between pump flange and centre of round stamp at lower oblong hole of control lever. The distance must be 46.7 ± 3.5 mm.

If the actual value is outside the permissible tolerance a new control lever base must be used.

The following procedure should be adopted:

Attach new control lever base to control-lever shaft.

Attach top of control lever in such a manner that markings on control lever and shaft tally.

Screw hexagon nut with retainer onto control-lever shaft.

Insert fastening screw for both control levers and tighten slightly.

Set low-idle speed regulation in accordance with test-specification sheet. Dimension "A" does not apply.

Loosen fastening screw of control levers.

Set distance between pump flange and center of round stamp at lower oblong hole on control lever. (Fig. 2)

Tighten fastening screw. Tightening torque 6...8 Nm (0.6...0.8 kp).

Set full-load speed regulation.

Unscrew hexagon nut of control-lever shaft.

Remove complete control lever, from control-lever shaft.

The positions of the two pieces of the control lever with respect to one another should not be changed any more.

Until the stamping tool KDEP 1107 is available drill control levers at pre-drilled point (top of lever) (arrow a, Fig. 2) and rivet together or attach by means of a dowel pin. Dia. 4 mm drill.

Attach control lever to control-lever shaft such that markings on control lever and shaft tally. Recheck idle and full-load speed regulation.

2. New spacer sleeve for limiting full-load delivery

All VE..F.. distributor-type fuel-injection pumps are being provided with longer threaded pins (88) as full-load stop screws. These threaded pins are secured by way of an external spacer sleeve (93)(Fig.3). The previous internal spacer sleeve between the housing cover and threaded pin is no longer necessary.

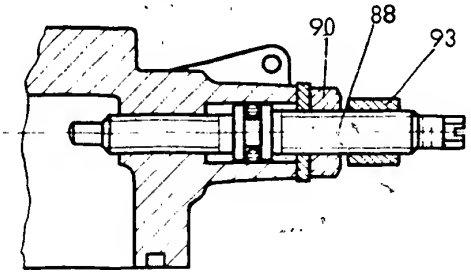

Fig. 3

The new spacer sleeve (93) cannot be removed from the threaded pin (88) and thus when performing repairs a new threaded pin and new spacer sleeve are to be used.

The new threaded pin is interchongeable. The previaus threaded pins with internal spacer sleeve can be used up.

When using a new threaded pin with external spacer sleeve the following procedure is to be adopted for test purposes (full-load limiting):

Preset full-load delivery.

Push new spacer sleeve onto threaded pin until contact is made with locknut (90).

Guide stamping tool KDEP 1106 over spacer sleeve until contact is made with locknut (90). Insert stamping screw by hand until it touches spacer sleeve, then give a further 1 1/2 - 1 3/4 turns.

F9

Unscrew stamping screw and remove stamping tool.

There should be no gap between spacer sleeve and locknut.

3. Sleeve for securing the pump cover

All distributor-type fuel-injection pumps VE..F.. have a fixture between the housing cover or manifold-pressure compensator housing and the pump housing.

The fixture consists of a fitting sleeve on the mounting hole next to the full-load stop.

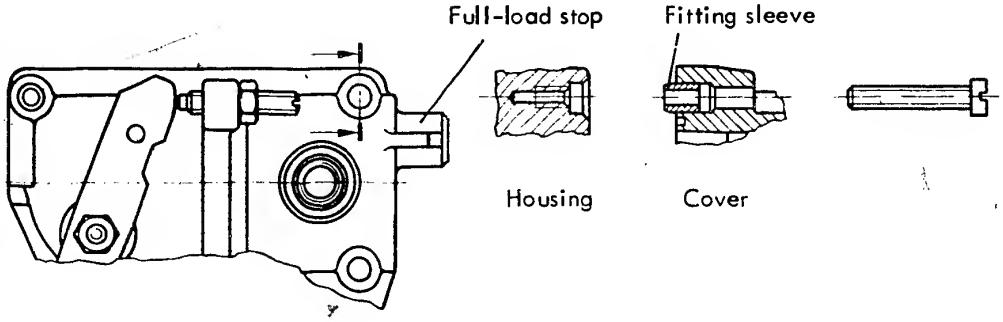

Fig. 4

When equipping previous pumps with new covers the fitting sleeve is to be removed.

4. Insertion of a new seal ring (92)

The seal ring (92) of the housing cover will in future have 12 "tabs" around the edge. These tabs are designed to prevent the seal ring from falling out when mounting the housing cover. The previous seal rings can be used up.

5. New slotted shoulder screw (104)

The slotted shoulder screws on the sides of all distributor-type fuel-injection pumps VE..F.. have been changed from hexagon bolts to tamperproof triangle-head bolts (Fig. 5). These slotted shoulder screws are designed to support the fulcrum levers.

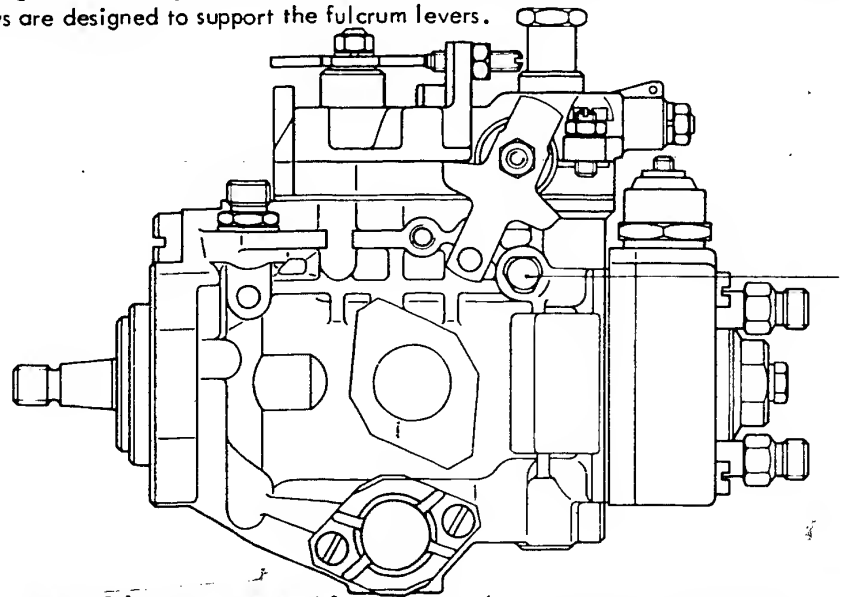

Fig. 5

The socket wrench KDEP 1087 must be used for tightening/loosening the slotted shoulder screws.

F10

6. Axial clearance of governor assembly

The fact that the axial clearance of the governor assembly had been increased to 0.35...0.55 mm was published in Technical Bulletin VDT-I-460/105.

Since then this increased axial clearance has repeatedly been quoted as being the cause of various vehicle defects.

Specific tests have shown that the axial clearance of the governor assembly has no influence on the smooth running of the engine nor on vehicle handling.

The stop pin for the governor assembly is merely designed to prevent the weight of the governor assembly overcompressing the starting spring if the pump (or vehicle) is inclined.

7. Fastening of plug, item 117 or 827 (for various versions)

The tab washer 1 461 290 301 is now used for fastening these plugs instead of the retainer 1 464 601 301. The use of the retainer or tab washer depends on the plug design. The retainer is still available under the part number 1 464 601 301.

8. Modified tightening torque for fostening screws (38) of timing device cover on spring end

The tightening torque for the obove-mentioned fastening screws has been changed from 6...8 Nm (0.6 ... 0.8 kpm) to 5.. . 6 Nm (0.5 ... 0.6 kpm).

In the case of fuel-injection pumps with flat-head screws the tightening torque is 8...10 Nm (0.8 ... 1.0 kpm).

9. Injection timing as per "pointer method"

Various distributor-type fuel-injection pumps VE..F.. ore fitted with a side inspection window.

The pointer is set as follows:

Proceed as per repair instructions up to and including " adjustment of plunger lift to port closing".

Switch off test bench but do not dismantle fuel-injection pump.

Remove cover of inspection window.

Turn drive shaft in direction of rotation of pump until mark on cam plate is visible. The Woodruff key slot in the drive shaft points towards the delivery outlet.

Continue turning slowly until required lift as per test specification sheet is achieved.

In this position move pointer until it tallies with mark on cam plate.

Turn drive shaft back ond recheck setting.

Mount closing cover of inspection window.

Remove plunger lift to port closing measuring tool and remove fuel-injection pump from test bench.

Proceed as per repair instructions .

For engine mounting the measuring tool KDEP 1085 can be used as a check.

10. New KDEP tools for distributor-type fuel-injection pump repairs and testing

All special tools previously intended for user manufacture have been incorporated into the KDEP tool range and are contained in the new tool board KD-VA-Z (cf. catalogue sheet KD-EP 9 D 11.77).

11. Functional test of solenoid-type stop valves

A functional test of the solenoid valves must be performed after installation.

If a functional test is performed when the valves are not fitted cooling is insufficient and damage to the solenoid valves cannot be excluded.

F12

Change in gasket for delivery-valve assembly

As from FD 930, all distributor-type fuel-injection pumps type VA..C.. will be equipped with bronze gaskets 1 460 105 302 (Item 83 in the Service Parts List) instead of the copper gaskets used previously.

For all distributor-type fuel-injection pumps type VA..C.. with bronze gaskets, the tightening torque of the delivery-valve holder is increased from 35 ... 45 Nm to 45 ... 55 Nm.

Bronze gaskets can be fitted during repairs on VA..C.. distributor pumps having an older FD.

It is to be noted that only gaskets of the same material are to be used on the same hydraulic head. The delivery-valve holders must be tightened with the appropriate torque.

Note

The copper gaskets will continue to be fitted on distributor pumps type VA.. up to and including the B-version, and the tightening torque of 35 ... 45 Nm will be retained for the delivery-valve holder.

BOSCH Geschäftsbereich KH Kundendienst Kfz Ausrüstung
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F13

BLEEDING

DISTRIBUTOR-TYPE FUEL-INJECTION PUMPS

VE..F..

VDT-I-460/120 En

1.1981

When installing distributor-type fuel-injection pumps on the engine, the fuel-injection pump and the fuel filter must always be filled with fuel.

Horizontally installed distributor-type fuel-injection pumps (picture) do not need bleeding because the fuel overflow is the highest point on the injection pump and the air in the injection pump is bound to be pumped back to the tank.

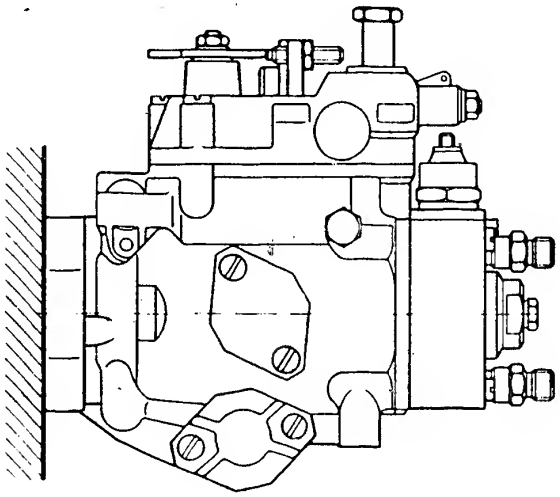

Fig. 1: Horizontally installed distributor-type fuel-injection pump

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If the installation position differs by more than 45° from the horizontal (Fig. 2), then in most cases it is necessary to bleed the distributor-type fuel-injection pump.

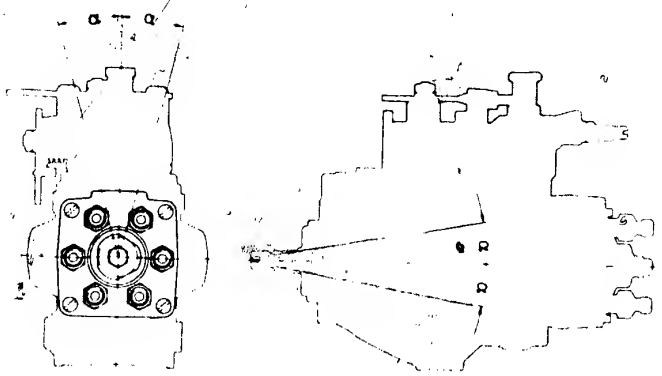


Fig. 2: α = Angle of inclination

Procedure:

1. Vertical installation

To bleed vertically installed distributor-type fuel-injection pumps, unscrew the hexagon bolt in the central screw plug of the hydraulic head (arrow in Fig. 3) until the flattened section on the thread is visible.
Operate the starting motor until the fuel escaping is free of bubbles. Then re-tighten the hexagon bolt.

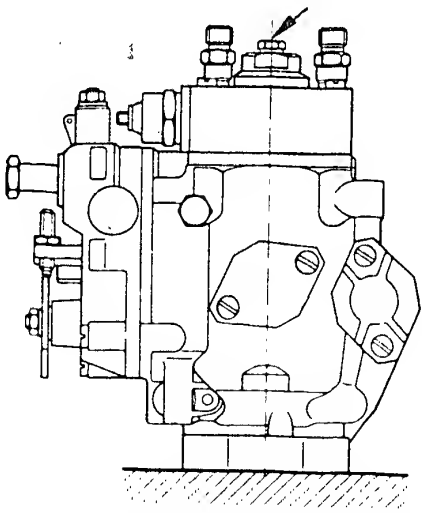


Fig. 3: Vertically installed distributor-type fuel-injection pump

F15

On various models of distributor-type fuel-injection pump (VE) a hexagon-socket-head cap screw is positioned below the solenoid valve (arrows in Fig. 4 and Fig. 5).

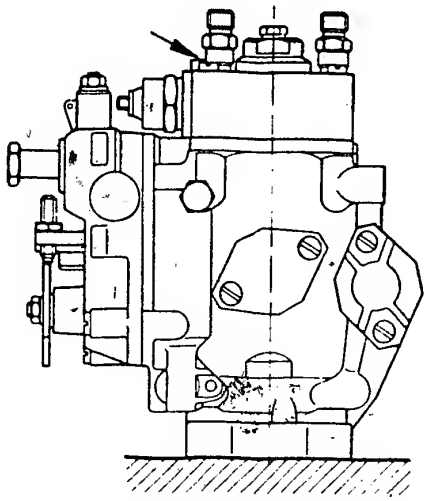


Fig. 4

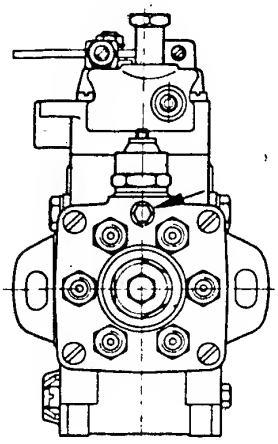


Fig. 5

To bleed these pump models, loosen this hexagon-socket-head cap screw. Operate the starting motor until the fuel escaping is free of bubbles. Then re-tighten the hexagon-socket-head cap screw.

2. Horizontal installation

To bleed horizontally installed distributor-type fuel-injection pumps (Fig. 6) it is necessary, as in the case of vertical installation, to loosen the hexagon bolt (arrow) in the central screw plug of the hydraulic head and, when the fuel escaping is free of bubbles, to tighten it again.

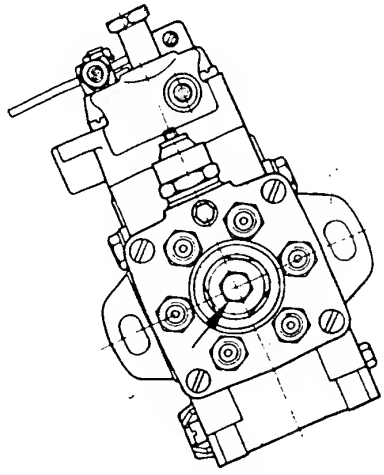


Fig. 6: Horizontally or obliquely installed distributor-type fuel-injection pump

F16

On various pump models the bleeder screw is positioned on the side of the pump housing (Fig. 7).

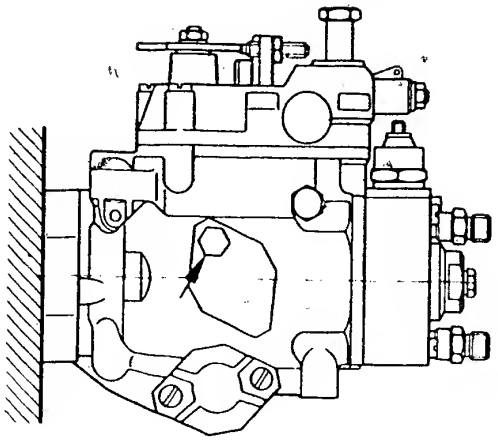


Fig. 7: Distributor-type fuel-injection pump drawn horizontal for better view.

To bleed these distributor-type fuel-injection pumps it is necessary to loosen the hexagon bolt (arrow) shown in the diagram. Operate the starting motor until the fuel escaping is free of bubbles. Then re-tighten the bolt.

In distributor-type fuel-injection pumps VE...F with two-part control lever (double spring combination), the control lever does not always return to the idle stop. The cause of the fault is the lack of lubricating grease on the spring, stop bushing and cover.

Remedy:

The lubricating grease on the control lever must not be washed away. Whenever the engine is washed this area must be relubricated with multi-grade grease or at least with engine oil.

It is necessary to lubricate both return springs and the the lower stop bushing when any after-sales service work or repairs are carried out.

REPAIRING AND TESTING NOZZLE-AND-HOLDER ASSEMBLIES

VDT-W 430/500 En
12.1984

supersedes WJP- 320/2
W - 432/300
W -433/300 Suppl. 1
W -433/301
W -434/300
I -434/1

1. General instructions

Nozzle-holder assemblies and nozzles are products manufactured with maximum precision. For that reason, watch for maximum cleanliness in all working and at the job site.

When it becomes dirty, replace the test oil per ISO 4113 with new test oil. In so doing, also take out and replace the filter element in the nozzle tester. After filling the new test oil in, purge in the inside of the instrument by operating the hand lever. In so doing, spray into the open, without having attached a nozzle-and-holder assembly.

Check the pressure gauge once a month with a more accurate comparison pressure gauge!

Be certain to use only the plunger-and-barrel assemblies, delivery-valve assemblies, and test pressure lines listed in the service parts list for the nozzle tester because different test preconditions result if other parts are used.

1.1 Instructions for the chatter test and spray test

When evaluating the nozzles, distinguish between new and used nozzles. Do not run the chatter test and spray test simultaneously!
Switch off the pressure gauge of the nozzle tester by closing the shutoff valve. This is necessary to protect the pressure gauge.
New nozzles:
The chatter test makes it possible to test by listening the ease of movement for the needle valve in the nozzle body. The readiness with which new nozzles chatter depends upon the following dimensions:
The diameters of the seat, guide, and blind hole. These determine groups of chatter characteristics that reproduce the chatter behavior of the nozzles.
If the nozzle does not chatter in spite of a cleaning, it is to be replaced with a new nozzle. The shape of the spray jet is not of importance in the chatter test.
A spray pattern conforming to specifications is present generally only on new nozzles.
Used nozzles:
The chatter behavior of the nozzle deteriorates due to wear in the seat region. For that reason, do not use the groups of chatter characteristics here. When the lever is moved quickly, the nozzle must chatter audibly and/or spray with good atomization. For used nozzles, the spray pattern can deviate from the ideal shape for the new nozzle. It is not possible in every instance to conclude that there is a negative effect on the operation of the engine from this. The spray pattern of such nozzles can, however, be perceptibly improved by means of appropriate cleaning actions.

1.2 Test instructions and test specifications for opening pressure

The opening pressure prescribed for a nozzle-and-holder assembly is stamped in in many cases on the nozzle-holder body.
If that is not the case, determine the value from the appropriate documents from the manufacturer of the engine. Generally, the tolerance for setting is + 8 bar.

For the DDAD (GMC/Chevrolet) nozzle-and-holder assemblies 0 432 217 081, 0 432 217 092, and 0 432 217 104, the following values apply:

When newly set:	125 + 10 bar
When checking:	min. 105 bar

2. Safety regulations

When working on the nozzle tester, observe the following:

Keep your hands away from the nozzle jet!

The jet from a nozzle penetrates deeply into the flesh of the finger or the hand, and destroys the tissue. The test oil penetrating into the blood can cause blood poisoning.

3. Tightening torques for assembly and installation

Screwed connection	Typ		
	KBAL(Z)..P.. Nm	KDAL(Z)..P.. Nm	KBEL(Z).. Nm
Nozzle-retaining nut	30...40	40...40	40...50
Union nut for the delivery line	15...25	15...25	15...25
Inlet connector in the holder body	-	-	30...45
Inlet-union screw for leakage connection	2...4	2...4	1)
Tube fitting for leakage connection	-	-	-
Union nut for leakage connection	-	-	-
Inlet-union screw for cooling oil connection	-	-	-
Screw plug	-	-	-
Locking nut for setting screw	-	-	-
Cap nut	-	-	-

1) Thread M6x1 = Tightening torque = 2...4 Nm
Thread M8x1 = Tightening torque = 4...6 Nm
Thread M10x1 = Tightening torque = 6...8 Nm

e of nozzle-and-holder assembly				
P..	KDEL(Z)..P.. Nm	KBEL(Z)..S.. Nm	KDEL(Z)..S.. Nm	KB(L)..S.. Nm
	40...50	50...70	50...70	70...90
	15...25	15...25	15...25	15...25
	30...45	30...45	30...45	45...65
	1)	1)	1)	1)
	-	-	-	-
	-	-	-	-
	-	-	-	-
	-	-	-	60...90
	-	-	-	5...15
	-	-	-	40...60

Tightening torques for assembly and installation (continued)

Screwed connection	Type		
	KBAL(Z)..S.. Nm	KDAL(Z)..S.. Nm	KCA..S.. Nm
Nozzle-retaining nut	70...90	70...90	70...90
Union nut for the delivery line	15...25	15...25	15...25
Inlet connector in the holder body	2) 45...65	2) 45...65	-
Inlet-union screw for leakage connection	1)	1)	-
Tube fitting for leakage connection	-	-	-
Union nut for leakage connection	-	-	-
Inlet-union screw for cooling oil connection	-	-	-
Screw plug	-	-	-
Locking nut for setting screw	-	-	-
Cap nut	-	-	-

1) Thread M6x1 = Tightening torque = 2...4 Nm
   Thread M8x1 = Tightening torque = 4...6 Nm
   Thread M10x1 = Tightening torque = 6...8 Nm

2) For nozzle-holder assemblies with a through stem (with no hea
   tightening torque = 30...45 Nm.

3) For inlet connectors with connection thread M 22x1.5, the ti

of nozzle-and-holder assembly

	KB..TA.. Nm	KBF..T.. Nm	KB..U.. Nm	KBF..U.. Nm
	100...140	100...140	200...220	200...220
	20...30	20...30	60...80	60...80
	3) 90...110	3) 90...110	120...140	120...140
	1)	1)	1)	1)
	-	-	50...60	-
	-	-	2...8	-
	-	30...40	-	30...40
	60...90	60...90	80...100	80...100
	10...20	5...10	30...40	10...20
	40...60	40...60	50...70	50...70

ead pressed on) and inlet connectors screwed on at the side,

ightening torque is 120...140 Nm

Tightening torques for assembly and installation (continued)

Screwed connection	Type		
	KBAL(Z)..P.. Nm	KDAL(Z)..P.. Nm	KBEL(Z)..P Nm
Screws for fastening flange 4)	10...20	-	10...20
Nozzle-holder assembly in the cylinder head	-	-	-
Retaining screw in cylinder head	-	50...60	-

Screwed connection	Type		
	KBAL(Z)..P.. Nm	KDAL(Z)..P.. Nm	KCA..S.. Nm
Screws for fastening flange 4)	10...20	-	-
Nozzle-holder assembly in the cylinder head	-	-	60...80
Retaining screw in cylinder head	-	60...80	-

4) For claw-type fastening, follow the manual of the manufacture

of nozzle-and-holder assembly

P..	KDEL(Z)..P.. Nm	KBEL(Z)..S.. Nm	KDEL(Z)..S.. Nm	KB(L)..S.. Nm
0	-	10...20	-	10...20
	-	-	-	-
	60...80	-	60...80	-

e of nozzle-and-holder assembly

	KB..TA.. Nm	KBF..T.. Nm	KB..U.. Nm	KBF..U.. Nm
	-	-	-	-
0	-	-	-	-
	-	-	-	-

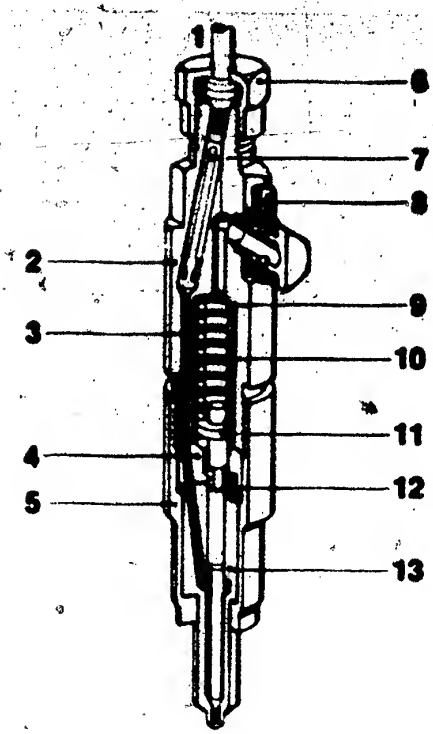
urer of the engine!

4. Tools and equipment, test oil

Nozzle-cleaning kit	KDEP 2900	
Mounting tool	KDEP 1043 *)	
Illuminating magnifier	0 681 104 000	
Nozzle tester	0 681 200 502	
Needle valve tester	1 688 130 153	
Quick-clamping device	0 681 243 006	for nozzles of size R
Quick-clamping device	0 681 243 003	for nozzles of size S
Quick-clamping device	0 681 243 004	for nozzles of size T
Universal nozzle-holder assembly	0 431 101 010	for nozzles of size R
Universal nozzle-holder assembly	0 681 243 005	for nozzles of size S
Universal nozzle-holder assembly	0 681 343 002	for nozzles of size T

Test oil per ISO 4113, or diesel fuel

*) An appropriate hole is to be put into the support plate KDEP 1043/0/1 on older mounting devices to accommodate the KCA holders.



1 = Inlet
2 = Supporting device
3 = Pressure channel
4 = Intermediate disc
5 = Nozzle-retaining nut
6 = Union nut for delivery line
7 = Edge-type filter
8 = Fuel leakage connection
9 = Pressure-adjusting shims
10 = Pressure spring
11 = Thrust pin
12 = Locking pins (to hold the nozzles in place)
13 = Injection nozzle

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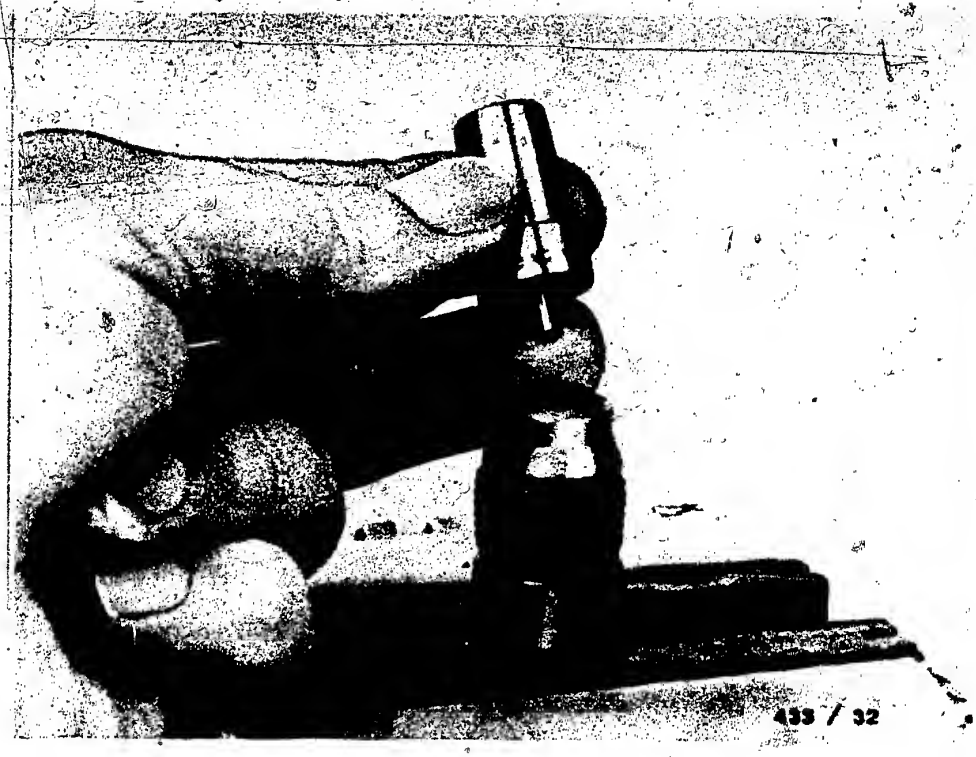
6. Dismantling the KCA nozzle-and-holder assembly

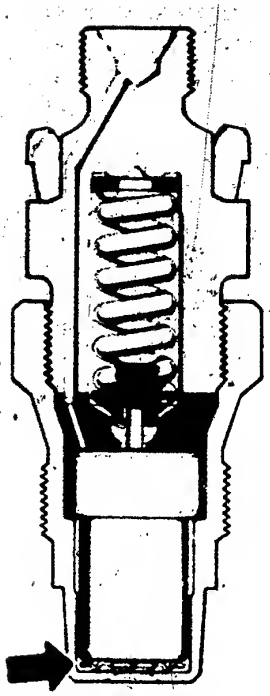
Take the complete nozzle-and-holder assembly out of the engine and, before dismantling it, check it on the nozzle tester. If need be, lay it in a cold cleaning solution, and clean the outside with the parts of the nozzle cleaning kit KDEP 2900 provided for that purpose.



Clamp the complete nozzle-and-holder assembly in the vise (using protective jaws!) in such a way that the nozzle points up.

Release the nozzle-retaining nut and unscrew it.

Take out the nozzle, the intermediate disc, the thrust pin, the pressure spring, and the shim plate from the holder and lay them to one side. (Do not damage the seal surface.)



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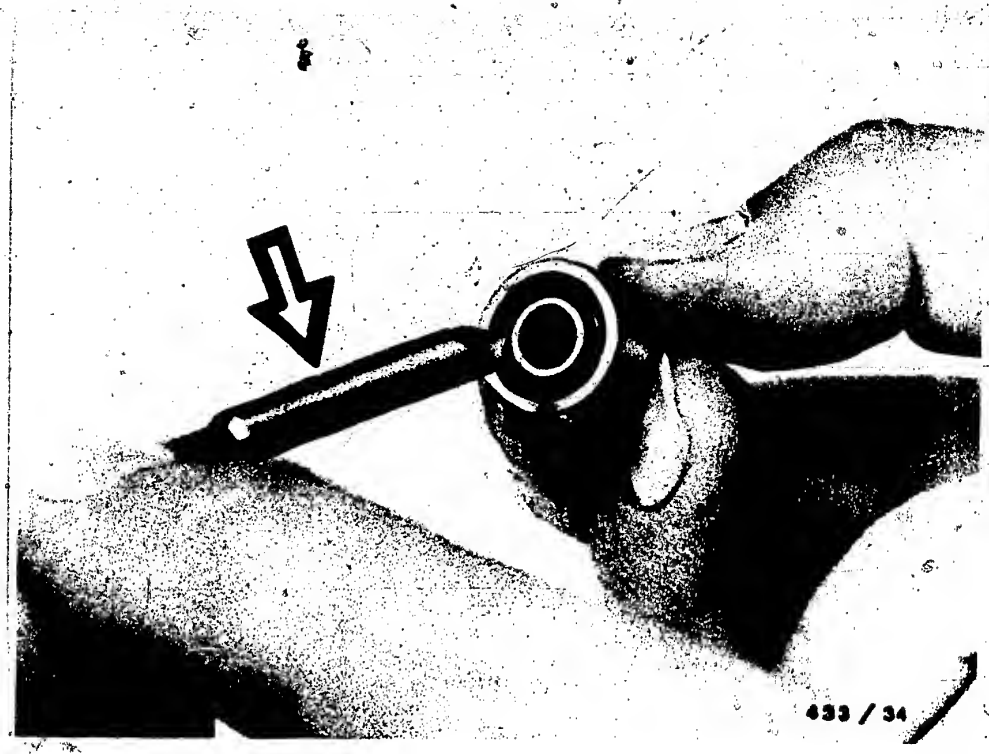
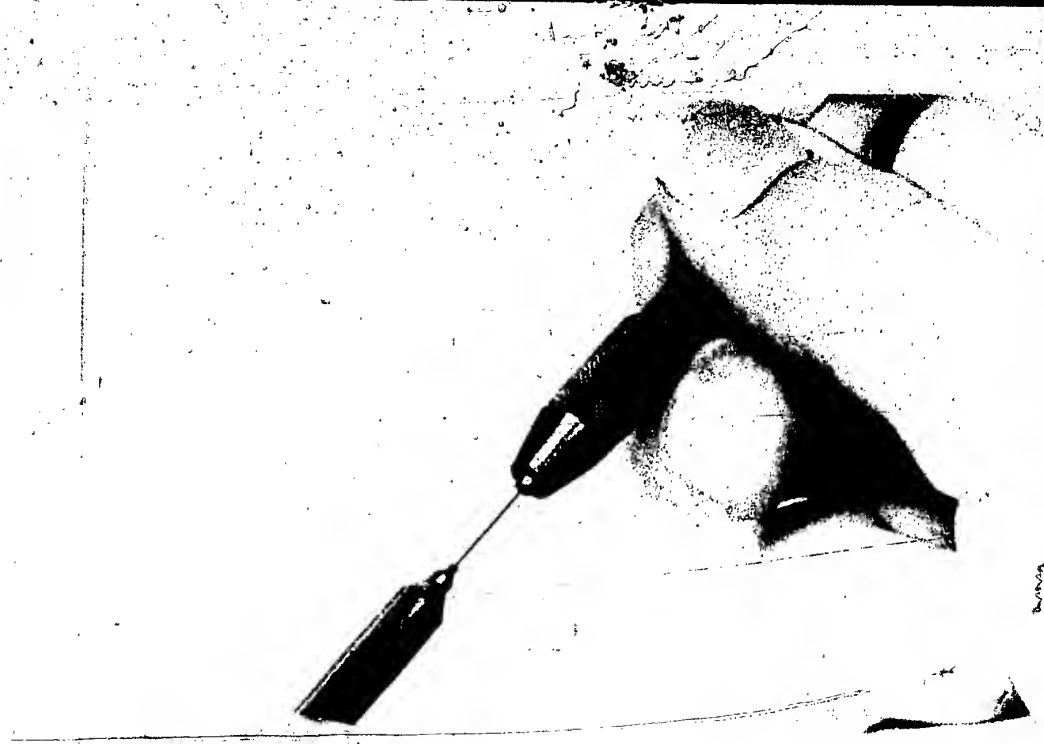
In the case of nozzle-and-holder assemblies with a thermal protection disc inserted in the nozzle-retaining nut (arrow), that disc must in every case be taken out and replaced with a new one.



6.1 Cleaning

When the nozzle-holder assembly has been taken apart, clean the individual parts with a cold cleaning solution.
Clean new nozzles in diesel fuel or test oil per ISO 4113. Clean dirt and residues of combustion from used nozzles with the nozzle-cleaning kit KDEP 2900. (See the Figure, arrow.) Then wash them out in the cold cleaning solution.



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For the needle valves of hole-type pintle nozzles, depending on the diameter of the hole, combustion residues are removed from the longitudinal hole in the pintle using cleaning needle KDEP 2900/5 (needle diameter 0.18 mm for hole diameter 0.20 mm) or KDEP 2900/3 (needle diameter 0.15 mm for hole diameter 0.18 mm). Clean the transverse hole using cleaning needle KDEP 2900/13. Then dip the needle valves into clean test oil or diesel fuel and insert them into the nozzle body.

6.2 Visual inspection - pintle nozzles

After cleaning, subject used nozzles to a visual inspection.

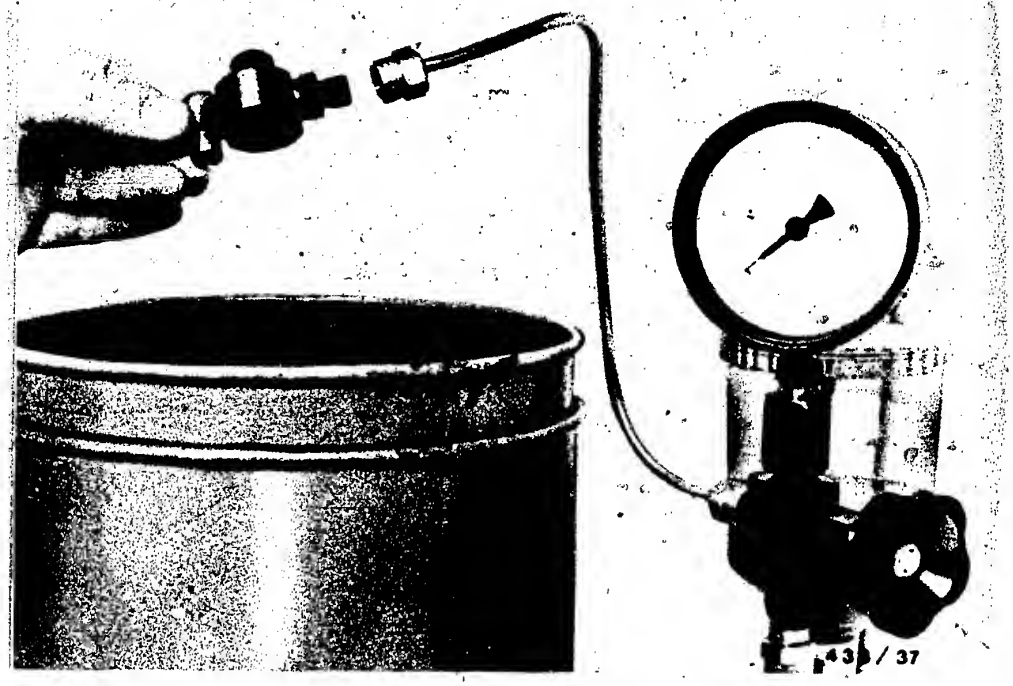
In that inspection, the following are not permissible on the needle valve:

- Damaged or rough needle valve seat
- A pintle that is broken off or damaged
- Coked transverse or longitudinal hole in the pintle (hole-type pintle nozzle)

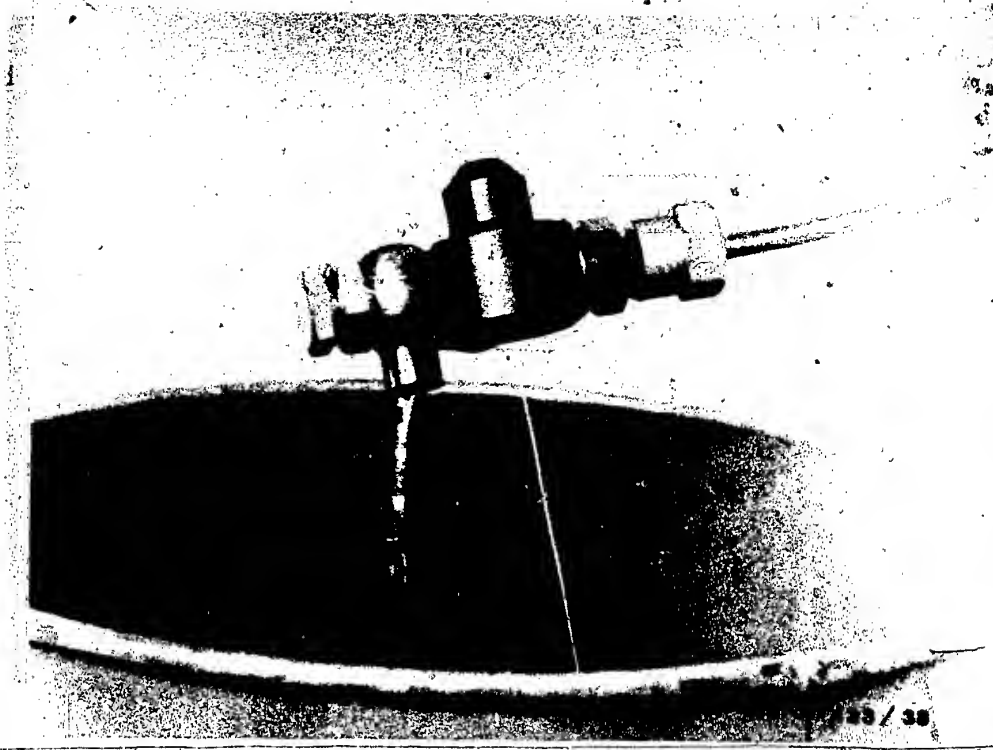
Examine the nozzle body with the illuminating magnifying glass 0 681 104 000 for pounding in or coking at the seat. The spray hole must be round and likewise must not be coked.

6.3 Checking the transverse and longitudinal holes in the pintle of the needle valve on hole-type pintle nozzles

Insert the the needle valve in the needle valve tester 1 688 130 153 and finger-tighten the retaining nut.



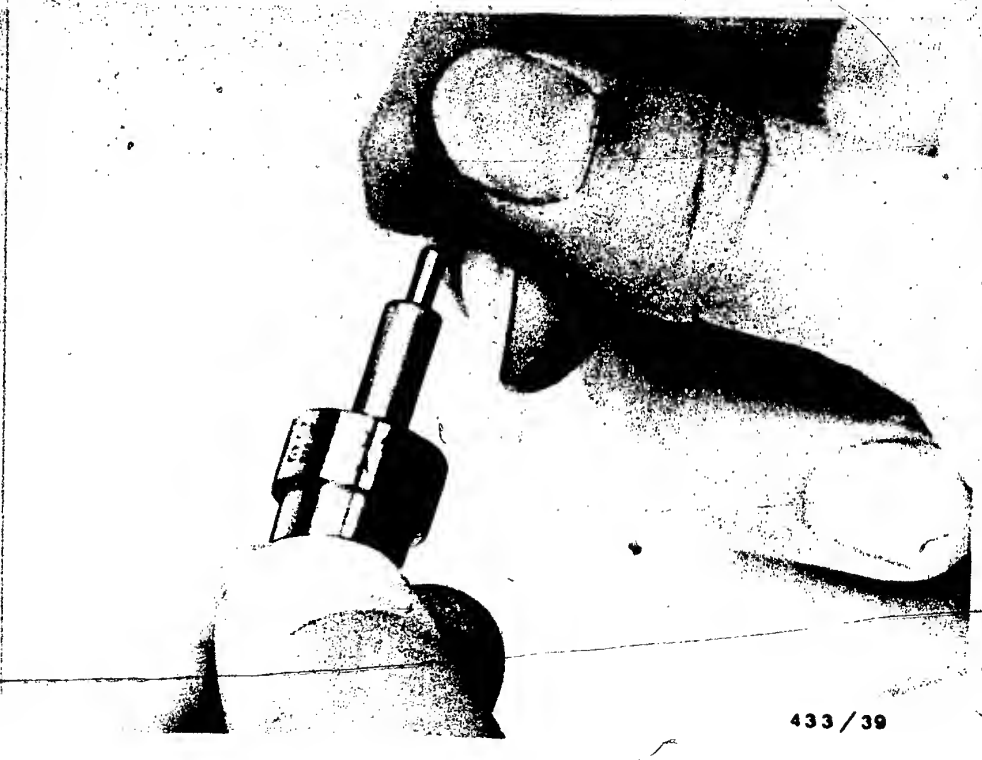
Connect needle valve tester 1 688 130 153 to the nozzle tester 0 681 200 502.
By moving the pump lever, increase the pressure until test oil comes out at the overflow valve on the needle valve tester.



With continued uniform, slow movement of the lever (4...6 seconds for one downward movement of the hand lever), a fine, clear, axial cord spray must come out of the longitudinal hole in the needle valve pintle. If no cord spray is visible, the longitudinal hole must be cleaned using the appropriate cleaning needle in the nozzle cleaning kit, or the complete nozzle must be taken out and replaced.

Unscrew the retaining nut from the needle valve tester. Remove the needle valve from the tester and insert it into its nozzle body.

Caution!
The needle valve and the nozzle body are paired to one another. For that reason, a needle valve must always be inserted into its own nozzle body!



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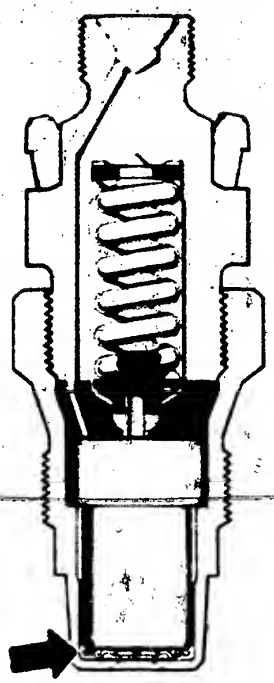
6.4 Sliding test

Run the sliding test after visual inspection of all nozzles (new or used).
First dip the needle valve into clean test oil or diesel fuel, and insert it into the nozzle body. Then, holding the nozzle body in an approximately vertical position, pull the valve by hand up to one-third of the way out of the nozzle body. When it is released, it must slide back to its seat due to its own weight.

6.5 Assembling the nozzle-and-holder assembly

Install all parts of the nozzle-holder assembly as called for in the service parts list into the nozzle body. Set the nozzle on the clean seal surface of the intermediate disc.

In the case of nozzle-holder assemblies with adapter pins, align the nozzle in such a way that the adapter pin of the holder can be introduced properly into the adapter pin holes on the nozzle.



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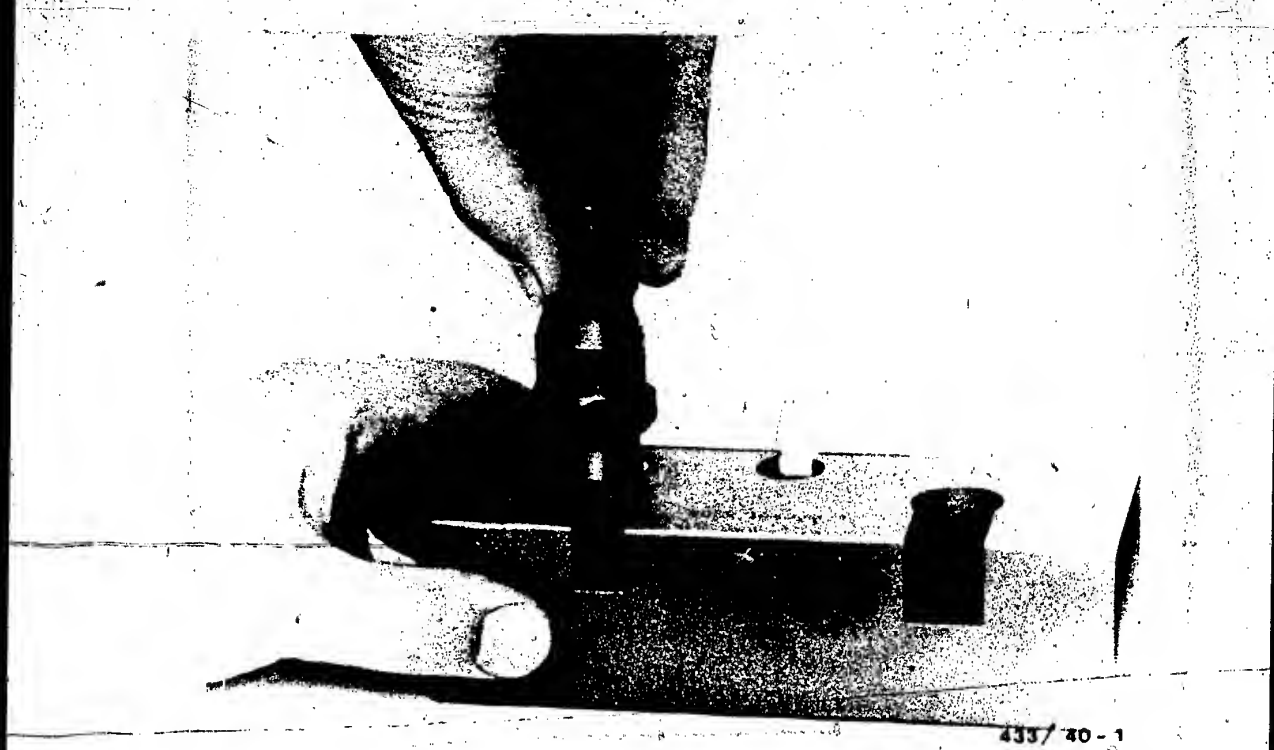
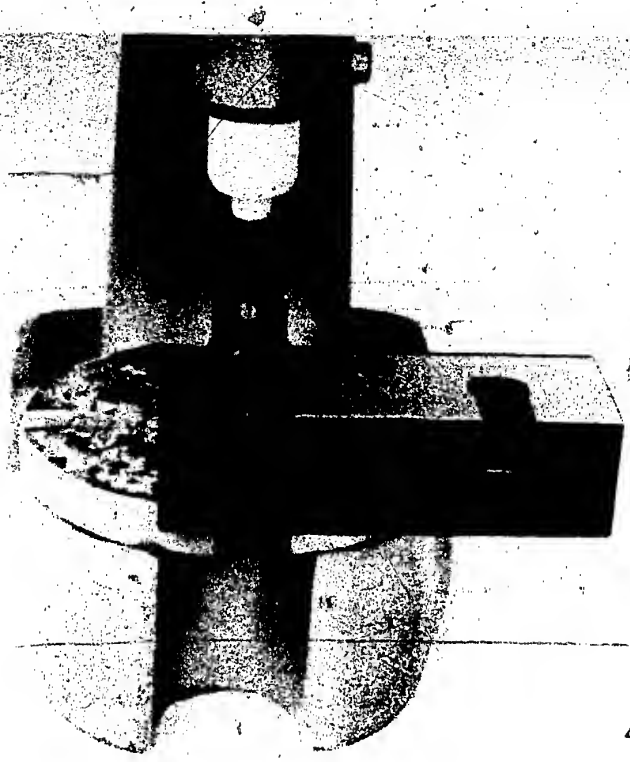
In the case of nozzle-holder assemblies with a thermal protection disc provided in the nozzle retaining nut (see the Figure, arrow), do not put this disc in yet. Because it may be used only once, it is not inserted into the nozzle retaining nut until after completing the adjustment of pressure.



Screw the nozzle retaining nut onto the supporting device. Before it touches the nozzle when being screwed tight, the complete nozzle-and-holder assembly is inserted into the recess provided for it on the support plate KDEP 1043/0/1. (See the Figure.)



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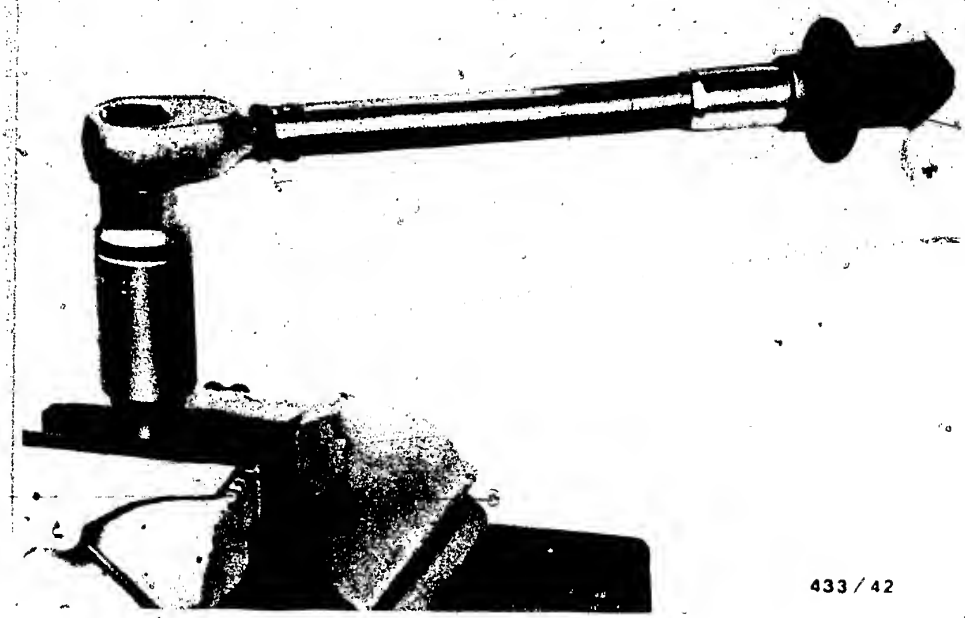
Insert the fitting pressure piece on the mounting device KDEP 1043 into the drill chuck of the drill press or the plunger receptacle on the hand-operated press.
Position the support plate with the nozzle-and-holder assembly on it under the pressure piece in such a way that the pressure piece presses on the portion of the nozzle furthest forward (see Figure).
By pressing on the nozzle, relieve the retaining nut, and screw it as far as possible onto the supporting device.



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Then remove the complete nozzle-and-holder assembly from the support plate and clamp it into the vise. (Use protective jaws!) Using a socket wrench and a torque wrench, tighten the nozzle retaining nut to the prescribed tightening torque of 70...90 Nm.

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7. Dismantling type KB..-, KD..-, and KE nozzle-and-holder assemblies

Take the complete nozzle-and-holder assembly out of the engine, and check it before dismantling. If need be, lay it in a cold cleaning solution, and clean the outside using the parts of the nozzle cleaning kit KDEP 2900 provided for that purpose.

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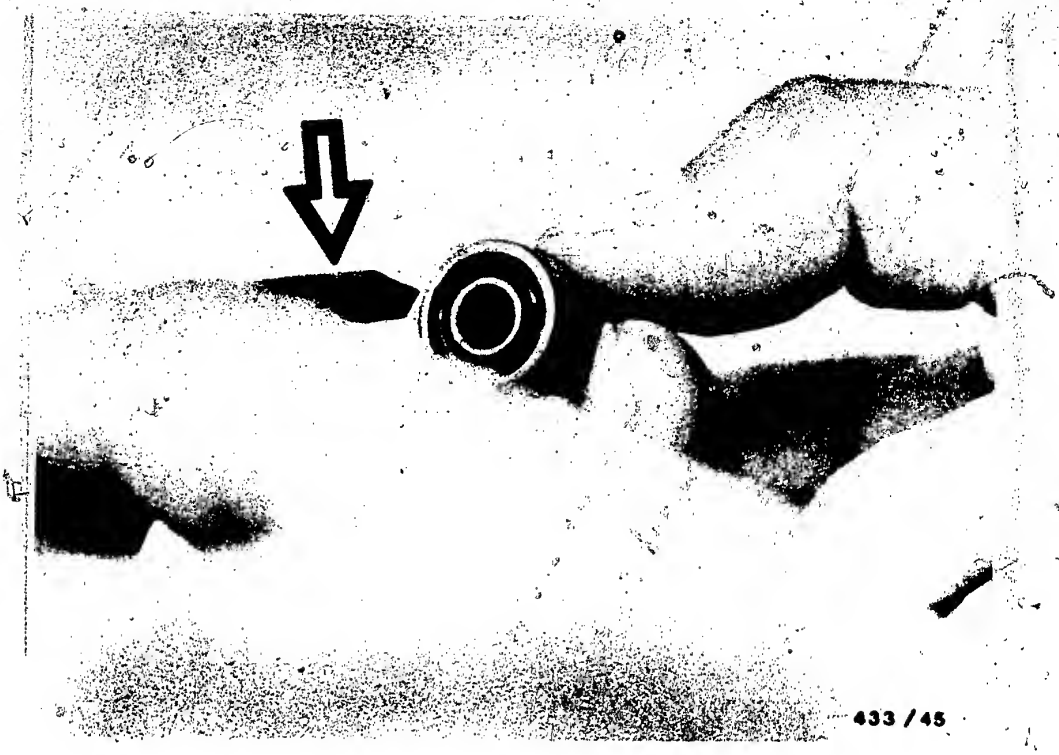
Clamp the complete nozzle-and-holder assembly in the vise (using protective jaws!) so that the nozzle points up. (See the Figure.)

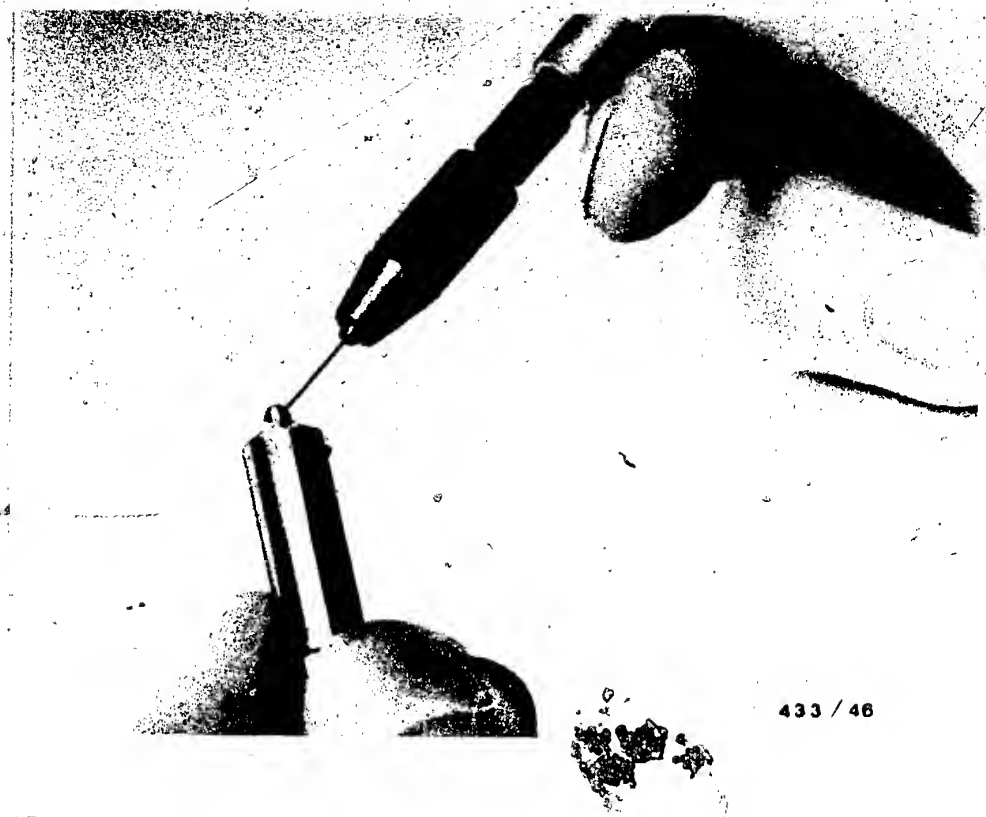
Release the nozzle retaining nut and unscrew it.

Take the nozzle, the intermediate disc, the thrust pin, the pressure spring, and the shim plate out of the holder and lay them to one side. (Do not damage the seal surface.)



7.1 Cleaning

When the nozzle-holder assembly has been taken apart, clean the parts with a cold cleaning solution. Clean new nozzles in diesel fuel or test oil per ISO 4113. Clean residues of dirt and combustion from used nozzles using the nozzle cleaning kit KDEP 2900. (See the Figure, arrow.) Then wash them out in a cold cleaning solution.



Clean the needle-valve seat and the pressure chamber of the nozzle body with toothpicks in diesel fuel. It is not permissible under any circumstances to use emery cloth, scrapers, or the like. Clean spray holes with appropriate cleaning needles of the nozzle cleaning kit KDEP 2900.

Then dip the needle valve into clean test oil or diesel fuel and insert it into the nozzle body.

7.2 Visual inspection - hole-type nozzles

After cleaning, subject used nozzles to a visual inspection.
If the needle valve seat has damage or rough spots, take out and replace the complete nozzle. Using illuminating magnifying glass 0 681 104 000, examine the nozzle body for pounding in or coking at the seat. Likewise examine spray holes for coking or other clogging.

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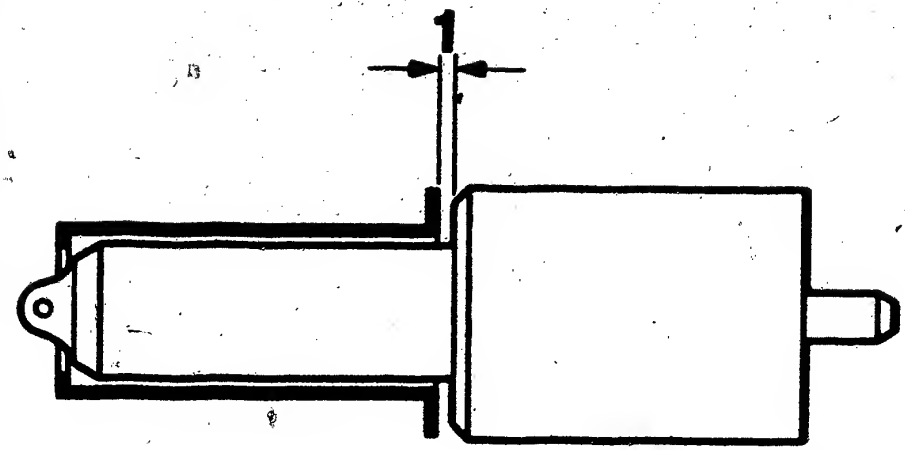
7.3 Sliding test

Run the sliding test after visual inspection of all nozzles (new or used).
First dip the needle valve into clean test oil or diesel fuel, and insert it into the nozzle body. Then, holding the nozzle body in an approximately vertical position, pull the valve by hand up to one-third of the way out of the nozzle body. When it is released, it must slide back to its seat due to its own weight.



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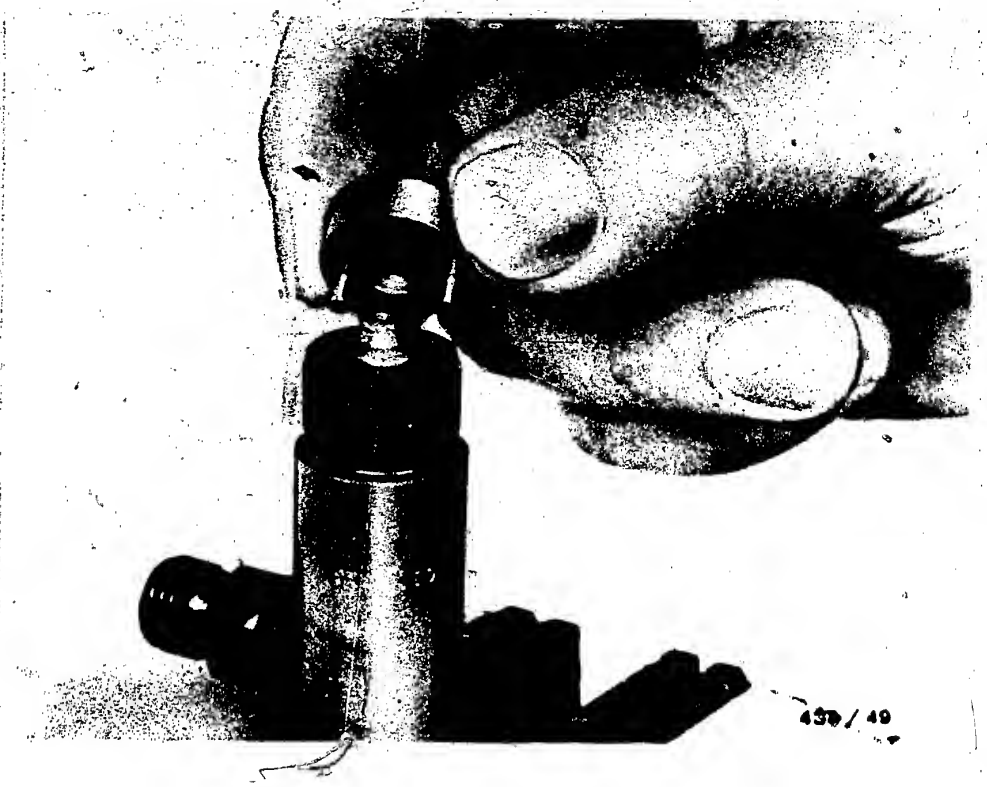
1 = Gap 0.1...0.55 mm

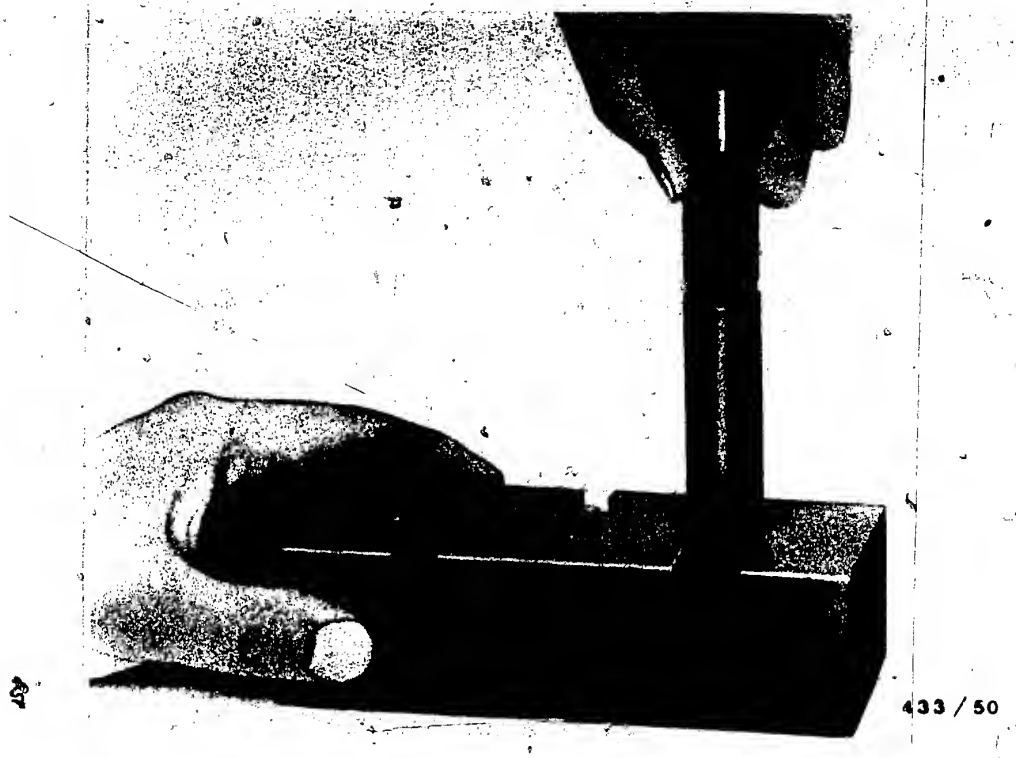
7.4 Assembling the nozzle-and-holder assembly

Instructions for nozzle-and-holder assemblies with a thermal protection sleeve

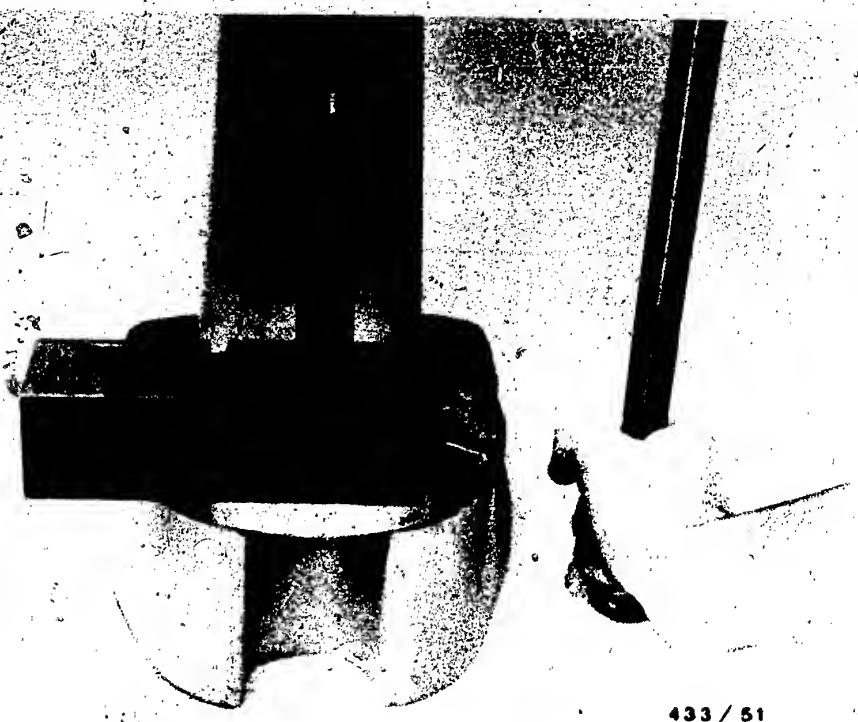
Take out and replace the thermal protection sleeves every time the nozzle-and-holder assembly is taken apart. The gap between the thermal protection sleeve and the nozzle body must be from 0.1...0.55 mm. To be checked before assembly.



Install all parts of the nozzle-holder assembly as called for in the service parts list into the nozzle-holder body.
Set the nozzle on the clean seal surface of the intermediate disc.
For nozzle-holder assemblies with adapter pins, align the nozzle in such a way that the adapter pins of the holder are introduced properly into the adapter pin holes of the nozzle.



Screw the nozzle retaining nut onto the supporting device. Before it touches the nozzle when being screwed tight, the complete nozzle-and-holder assembly is inserted into the recess provided for it on the support plate KDEP 1043/0/1.



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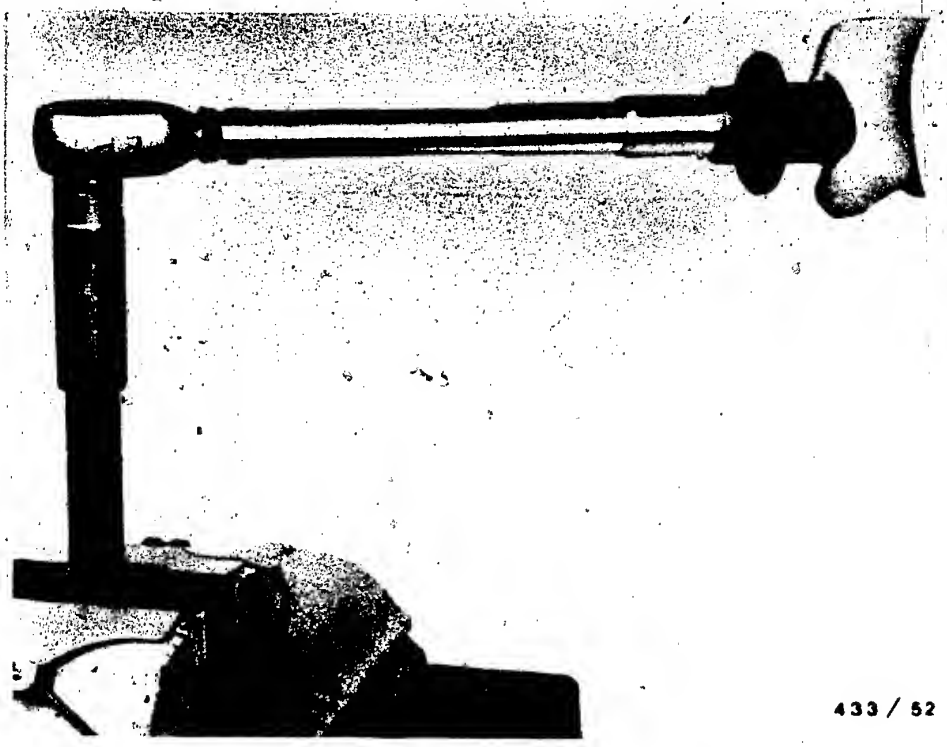
Insert the fitting pressure piece on the mounting device KDEP 1043 into the drill chuck of the drill press or the plunger receptacle on the hand-operated press.
Position the support plate with the nozzle-and-holder assembly on it under the pressure piece in such a way that the pressure piece presses on the portion of the nozzle furthest forward. By pressing on the nozzle, relieve the retaining nut, and screw it as far as possible onto the supporting device.



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Then remove the complete nozzle-and-holder assembly from the support plate and clamp it into the vise. (Use protective jaws!) Using a socket wrench and a torque wrench, tighten the nozzle retaining nut to the prescribed tightening torque.

Tightening torques for assembly

Screwed connection	Type		
	KBAL(Z)..P.. Nm	KDAL(Z)..P.. Nm	KBEL(Z).. Nm
Nozzle retaining nut	30...40	30...40	40...50
Inlet connector in holder body	-	-	30...45
Tube fitting for leakage connection	-	-	-

Screwed connection	Type		
	KBAL(Z)..S.. Nm	KDAL(Z)..S.. Nm	KB..TA.. Nm
Nozzle retaining nut	70...90	70...90	100...140
Inlet connector in holder body	45...65*	45...65*	90...110**
Tube fitting for leakage connection	-	-	-

*) For nozzle-holder assemblies with a through stem (without a p side, the tightening torque is 30...45 Nm.

**) For inlet connectors with connecting thread M22x1.5, the tigh

of nozzle-holder assembly

	KDEL(Z)..P.. Nm	KBEL(Z)..S.. Nm	KDEL(Z)..S.. Nm	KB(L)..S.. Nm
	40...50	50...70	50...70	70...90
	30...45	30...45	30...45	45...65
	-	-	-	-

f nozzle-holder assembly

	KBF..T.. Nm	KB..U.. Nm	KBF..U.. Nm
	100...140	200...220	200...220
	90...110**	120...140	120...140
	-	50...60	-

ressed-on head) and with inlet connectors screwed on at the

tening torque is 120...140 Nm.

8. Testing with nozzle tester

8.1 Testing pintle nozzles

Throttling pintle nozzles, pierced (hole-type) pintle nozzles, and flat-type pintle nozzles
Test criteria:

- Opening pressure
- Leakage
- Chatter behavior
- Spray pattern
- Preliminary spray of the hole-type pintle nozzle

For testing, use only clean test oil per ISO 4113 or clean diesel fuel.

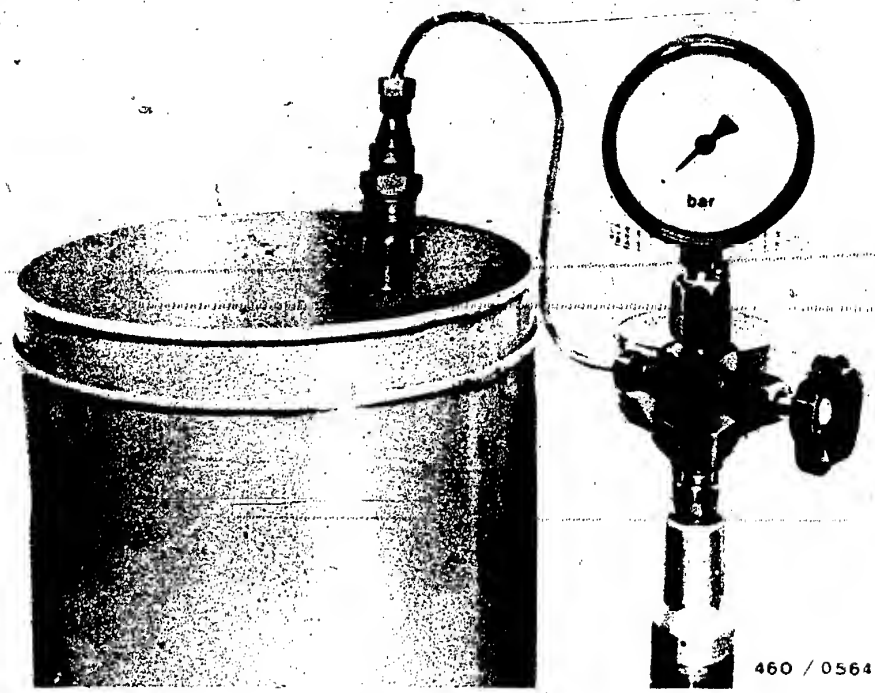
Test nozzles with appropriate nozzle-holder assemblies.

If nozzles are supplied for testing without the nozzle-holder assemblies that belong with them, the following nozzle-holders or quick-clamping devices can be used:

Nozzle Size	Nozzle Holder Part No.	Quick-Clamping Device * Part No.
R	0 431 101 010	0 681 243 006
S	0 681 243 005	0 681 243 003
T	0 681 343 002	0 681 243 004

* There must always be a damping spring installed in the quick-clamping device.

Nozzles of type DNA must always be tested together with the nozzle-holder assembly that goes with them, because these nozzles have only one inlet hole without a ring slot. (Nozzle-holder assemblies with a locking pin.)



Connect the nozzle-and-holder assembly and the appropriate delivery line to nozzle tester 0 681 200 502 (EFEP 60 H). To guarantee that a nozzle is not incorrectly gripped, push several times strongly on the hand lever for the nozzle tester with the pressure gauge switched off (approx. 4 to 6 downward movements per second).

When working on the nozzle tester, follow the safety regulations below:

Keep your hands away from the nozzle jet!

The jet from a nozzle penetrates deeply into the flesh of the finger or the hand, and destroys the tissue. The test oil penetrating into the blood can cause blood poisoning.

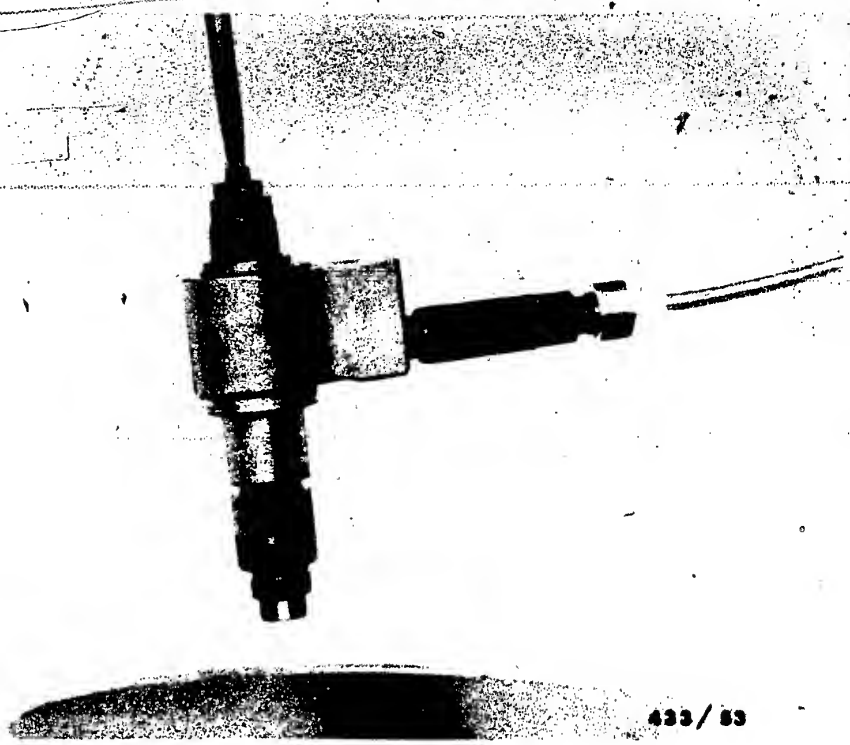
8.1.1 Checking opening pressure

Open the shutoff valve on the pressure gauge by approx. 1/4 turn.
Slowly press down on the hand lever of the nozzle tester. The pressure shown on the pressure gauge then rises. Observe the pressure at which the needle of the pressure gauge stops (without the nozzle chattering), or when the pressure drops off suddenly (the nozzle chatters). The maximum pressure attained is the opening pressure.
The opening pressure provided for a nozzle-and-holder assembly is stamped in in some cases on the nozzle-holder body.
If that is not the case, the value must be obtained from the corresponding documents from the manufacturer of the engine or from the microfiche cards on equipment (A...). The tolerance for settings is generally + 8 bar.

The following values apply for the DDAD (GMC/ Chevrolet) - nozzle-and-holder assemblies 0 432 217 081, 0 432 217 092, and 0 432 217 104:

For rechecking: min. 105 bar

For new setting: 125 + 10 bar



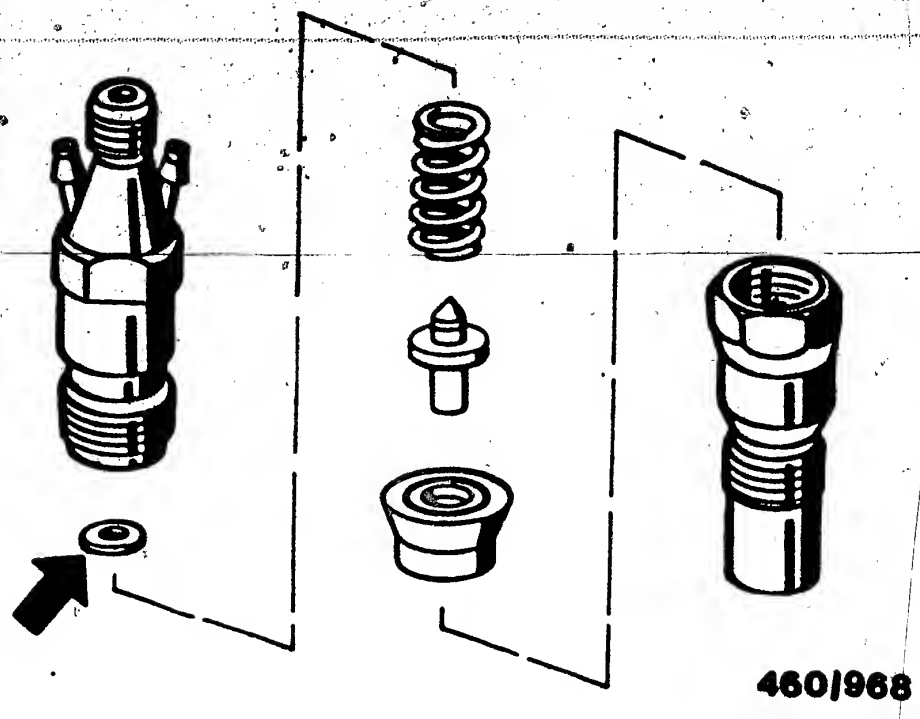
8.1.2 Setting the opening pressure (KB(L)..S.., KB(F)..T.., KB(F)..U..)

Unscrew the closure cap. Release the lock nut and turn the setting screw until the prescribed opening pressure has been attained. Turning the screw further in raises the opening pressure. Once the opening pressure has been attained, tighten the locking nut to the prescribed torque and screw the closure cap back on.

8.1.3 Tightening torques

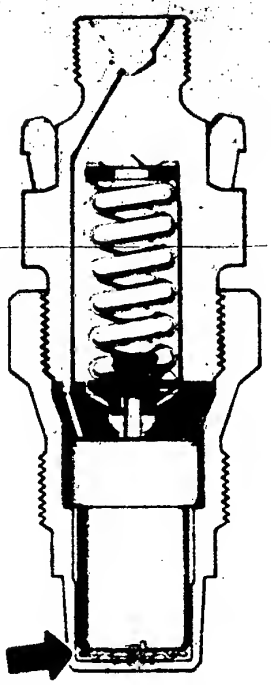
Screwed connection	Type of nozzle-holder assembly		
	KB(L)..S.. Nm	KB..TA.. Nm	KBF..T.. Nm
Locking nut (for setting screw)	5...15	10...20	5...10
Cap nut (closure cap)	40...60	40...60	40...60

Screwed connection	Type of nozzle-holder assembly	
	KB...U.. Nm	KBF...U.. Nm
Locking nut (for setting screw)	30...40	10...20
Cap nut (closure cap)	50...70	50...70



8.1.4 Setting opening pressure (KCA..S)

Unscrew the complete nozzle-and-holder assembly from the delivery line of the nozzle tester and clamp it into the vise. Use protective jaws!
Unscrew the nozzle retaining nut, take off the nozzle and lay it to one side. Remove all other parts of the nozzle-holder assembly. The opening pressure is set by selecting the adjusting shim required. (See the Figure, arrow.) A thicker shim raises the opening pressure. Then reassemble the nozzle-and-holder assembly as described and test on the nozzle tester.



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Once the prescribed opening pressure has been attained, for nozzle-and-holder assemblies with built-in thermal protection, install a new thermal-protection disc in the proper position in the nozzle retaining nut. (See the Figure, arrow.)

8.1.5 Test for leaks

The shutoff valve on the pressure gauge of the nozzle tester remains open by approx. 1/4 turn.
To make a reliable evaluation of leakage possible, dry off the bottom portion of the nozzle and the nozzle-holder assembly. (Blow it dry with air.)
Slowly press down on the hand lever of the nozzle tester until the pressure gauge indicates 20 bar less than the opening pressure as read previously. The nozzle does not leak if there is no drop dripping at the opening of the nozzle within 10 seconds.

If however a drop drips off, take the nozzle-and-holder assembly apart again, clean the parts of the nozzle holder and the nozzle, and thus eliminate the leak.
If the nozzle is leaking again when the test is repeated, replace it with a new nozzle. It is not permissible to remachine parts of the nozzle.

For nozzle-and-holder assemblies with a built-in thermal protection, take out and replace the pertinent thermal protection disc between the nozzle and the nozzle retaining nut every time the assembly is taken apart.

8.1.6. Chatter test, evaluation of the spray pattern

General information:
When evaluating the nozzles, distinguish between new and used nozzles.
Run the chatter test and the spray test one after the other!
Switch the pressure gauge of the nozzle tester off by closing the shutoff valve.
That is necessary to protect the pressure gauge.

New nozzles:
The chatter test makes it possible to test by listening for the ease of movement of the needle valve inside the nozzle body. If a nozzle does not chatter in spite of cleaning, it is to be taken out and replaced with a new nozzle. In the chatter test, the shape of the spray is of no significance. A spray pattern conforming to specifications is generally present only with new nozzles.

Used nozzles:
The chatter behavior of the nozzle deteriorates due to wear in the seat region. When the lever is moved quickly, the nozzle must chatter audibly and/or spray with good atomization. On used nozzles, the spray pattern can deviate from the ideal shape for a new nozzle. It is not possible in every case to conclude that there will be a negative effect on the operation of the engine from this.
However, the spray pattern of such nozzles can be improved perceptibly by means of appropriate cleaning actions.

Pintle nozzles without throttling (new nozzles) DN..R.., DN..S.., DN..T..

Chatter test:
These pintle nozzles chatter quite audibly across the entire range of lever speed that can be attained.
Minimum testing speed: 1 downward movement of the hand lever per second.
The occurrence of small interim ranges without chatter is of no significance. The shape of the spray is likewise of no significance during the chatter test.

Spray pattern:
A well-atomized even spray regardless of the speed of testing. (Watch the spray angle.)

Throttling pintle nozzles, including pierced (hole-type) pintle nozzles, not including flat-type pintle nozzles, and not including the model for DDAD (GMC-Chevrolet) DN 0 SD 248 - 0 434 250 105 or DN 0 SD 253 - 0 434 250 111

DN..RD.., DN..SD.., DN..TD..

Chatter test:

Due to its special structural features, this nozzle chatters very softly. With it, a chatter test is possible only when the hand lever is moved downward between 1...2 times per second.
If the testing speed is increased, the chatter stops. The test oil then comes out of the nozzle with a hissing sound. Only when the hand lever is moved suddenly and quickly (approx. 4...6 downward movements per second) does the nozzle chatter with a high-pitched tone.

Spray pattern: (applies only to new nozzles)
It is possible to evaluate the shape of the spray only if the hand lever is moved quickly. (4...6 downward movements per second.) The spray must be compact and well atomized.

Throttling pintle nozzle, model for DDAD (GMC/Chevrolet) DN 0 SD 248 - 0 434 250 105 or DN 0 SD 253 - 0 434 250 111 in nozzle-and-holder assemblies 0 432 217 081, 0 432 217 092 and 0 432 217 104

Chatter test:
Due to the special structural features, run the chatter test as follows:
Slowly press down on the hand lever of the nozzle tester and find out whether chattering sounds can be heard. If no chatter is audible, keep moving the hand lever faster until the nozzle chatters.
If the nozzle cannot be brought to chatter, first unscrew the nozzle retaining nut, clean the seat surface for the nozzle's thermal protection disc and the nozzle retaining nut well, and, using a new thermal protection disc, put the retaining nut back on. If there is still no chattering attained, take out and replace the nozzle.

Spray test: (applies only to new nozzles)
Quickly press the hand lever on the nozzle tester downward suddenly. The fuel spray must be compact and well atomized.

Throttling pintle nozzle - flat-type pintle nozzle - DN..-SD..

These nozzles have a flat ground at the side of the pintle. The flat surface thus made produces an oval shape in the spray.

Chatter test:
Due to its special structural features, this nozzle chatters very softly. With it, a chatter test is possible only when the hand lever is moved downward between 1...2 times per second. If the testing speed is increased, the chatter stops. The test oil then comes out of the nozzle with a hissing sound. Only when the hand lever is moved suddenly and quickly (approx. 4...6 downward movements per second) does the nozzle chatter with a high-pitched whistling tone.

Spray pattern: (applies only to new nozzles)
Until the high-pitched whistling tone is reached, the spray can be in strands and can come out without atomization. A divided spray and the formation of streams are of no significance in this range. For evaluation of the spray shape, the hand lever is pressed down suddenly and quickly (4...6 downward movements per second). The spray must then be well atomized. The spray cross-section is oval in shape and is larger than the spray from a throttling pintle nozzle without the flat on the pintle.

Throttling pintle nozzle - Pintaux nozzles - DN...SD.., DNA..SD..

The base of these nozzles has a special shape and they have an additional spray cover through which the preliminary spray comes out.

Chatter test:
Due to its special structural features, this nozzle chatters very softly. With it, a chatter test is possible only when the hand lever is moved downward between 1...2 times per second. If the testing speed is increased, the chatter stops. The test oil then comes out of the nozzle with a hissing sound. Only when the hand lever is moved suddenly and quickly (approx. 4...6 downward movements per second) does the nozzle chatter with a high-pitched whistling tone.

Spray pattern: (applies only to new nozzles)
With a low testing speed, the majority of the delivery must exit through the preliminary spray hole at the side well-atomized and without heavy streaming. It is possible to evaluate the main spray only when the hand lever is moved quickly (approx. 4...6 downward movements per second). The spray must be compact and well atomized.

8.2 Testing hole-type nozzles

Test criteria:

- Opening pressure
- Leakage
- Chatter behavior
- Spray pattern

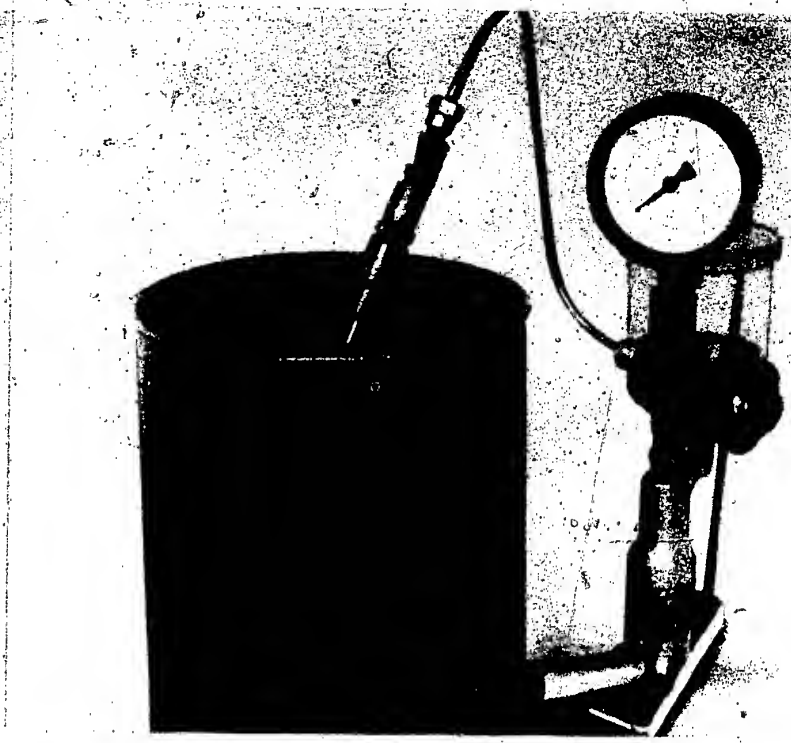
For testing, use clean test oil per ISO 4113 or clean diesel fuel.
Test the nozzles together with the nozzle-holder assemblies that go with them.

If nozzles are to be supplied for testing without the nozzle-holder assemblies that go with them, the following nozzle holders or quick-clamping devices can be used:

Nozzle Size	Nozzle Holder Part No.	Quick-Clamping Device *
P	----	----
S	0 681 243 005	0 681 243 003
T	0 681 343 002	0 681 243 004

* There must always be a damping spring put into the quick-clamping device.

Nozzles of type DLLA.. must always be tested with the nozzle-holder assembly that goes with them, because these nozzles have only one inlet hole without a ring slot. (Nozzle-holder assembly with locking pin.)



Connect the nozzle-and-holder assembly and the test pressure line that goes with it to the nozzle tester 0 681 200 502 (EFEP 60 H). In order to be certain that the nozzle is not incorrectly gripped, move the hand lever of the nozzle tester down suddenly several times forcefully with the pressure gauge switched off (approx. 4...6 downward movements per second).

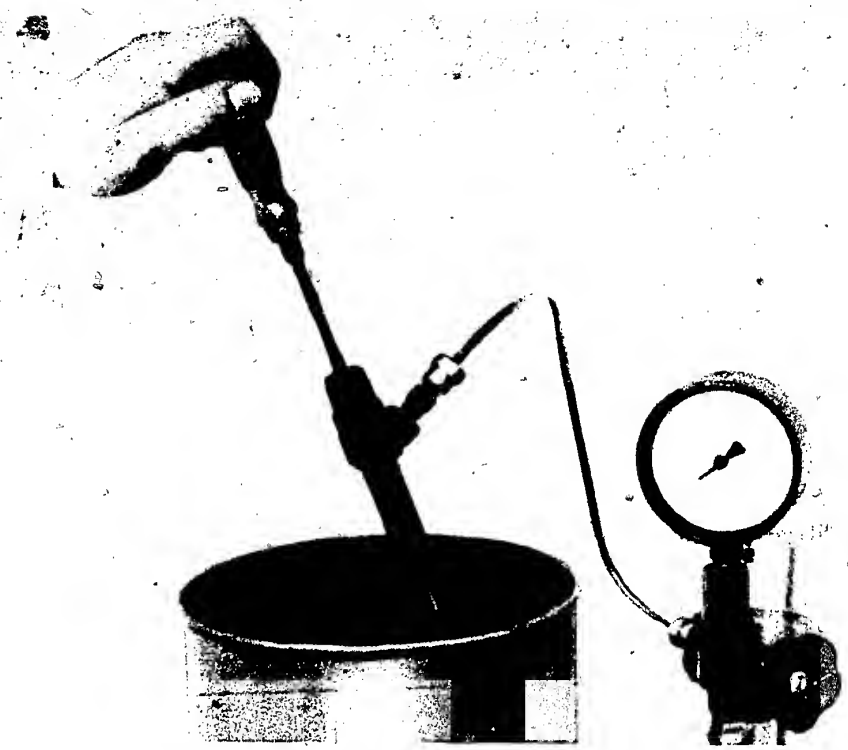
When working on the nozzle tester, follow the safety regulations below:

Keep your hands away from the nozzle jet!

The jet from a nozzle penetrates deeply into the flesh of the finger or the hand, and destroys the tissue. The test oil penetrating into the blood can cause blood poisoning.

8.2.1 Checking opening pressure

Open the shutoff valve on the pressure gauge by approx. 1/4 turn.
Slowly press down on the hand lever of the nozzle tester. The pressure shown on the pressure gauge then rises. Observe the pressure at which the needle of the pressure gauge stops (without the nozzle chattering), or when the pressure drops off suddenly (the nozzle chatters). The maximum pressure attained is the opening pressure.
The opening pressure provided for a nozzle-and-holder assembly is stamped in in some cases on the nozzle-holder body.
If that is not the case, the value must be obtained from the corresponding documents from the manufacturer of the engine or from the microfiche cards on equipment (A...). The tolerance for settings is generally + 8 bar.



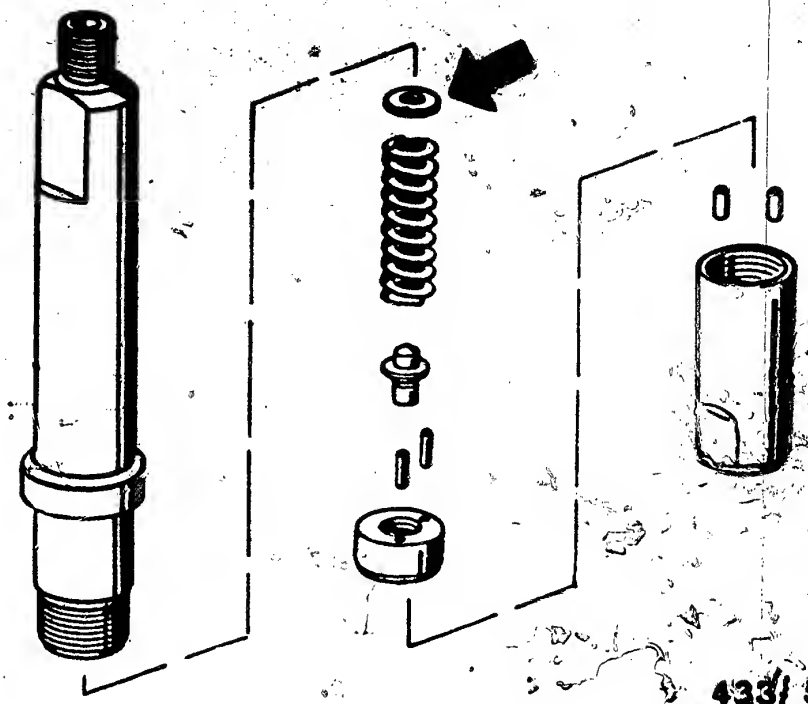
8.2.2 Adjusting opening pressure (KB(L)..S..,KB(F)..U..)

Unscrew the closure cap. Release the lock nut and turn the setting screw until the prescribed opening pressure has been attained. Turning the screw further in raises the opening pressure.
Once the opening pressure has been attained, tighten the locking nut to the prescribed torque and screw the closure cap back on.

8.2.3 Tightening torques

Screwed connection	Type of nozzle-holder assembly		
	KB(L)..S.. Nm	KB..TA.. Nm	KBF..T.. Nm
Locking nut (for setting screw)	5...15	10...20	5...10
Cap nut (closure cap)	40...60	40...60	40...60

Screwed connection	Type of nozzle-holder assembly	
	KB...U.. Nm	KBF...U.. Nm
Locking nut (for setting screw)	30...40	10...20
Cap nut (closure cap)	50...70	50...70



8.2.4 Adjusting opening pressure (KDAL(Z)..,KDEL(Z)..)

Unscrew the complete nozzle-and-holder assembly from the delivery line of the nozzle tester and clamp it into the vise.. Use protective jaws!
Unscrew the nozzle retaining nut, take off the nozzle and lay it to one side. Remove all other parts of the nozzle-holder assembly. The opening pressure is set by selecting the adjusting shim required. (See the Figure, arrow.) A thicker shim raises the opening pressure. Then reassemble the nozzle-and-holder assembly as described and test on the nozzle tester.

8.2.5 Test for leaks

The shutoff valve on the pressure gauge of the nozzle tester remains open by approx. 1/4 turn.
To make a reliable evaluation of leakage possible, dry off the bottom portion of the nozzle and the nozzle-holder assembly. (Blow it dry with air.)
Slowly press down on the hand lever of the nozzle tester until the pressure gauge indicates 20 bar less than the opening pressure as read previously. The nozzle does not leak if there is no drop dripping at the opening of the nozzle within 10 seconds.

If however a drop drips off, take the nozzle-and-holder assembly apart again, clean the parts of the nozzle holder and the nozzle, and thus eliminate the leak.
If the nozzle is leaking again when the test is repeated, replace it with a new nozzle. It is not permissible to remachine parts of the nozzle.

8.2.6 Chatter test and evaluation of the spray pattern

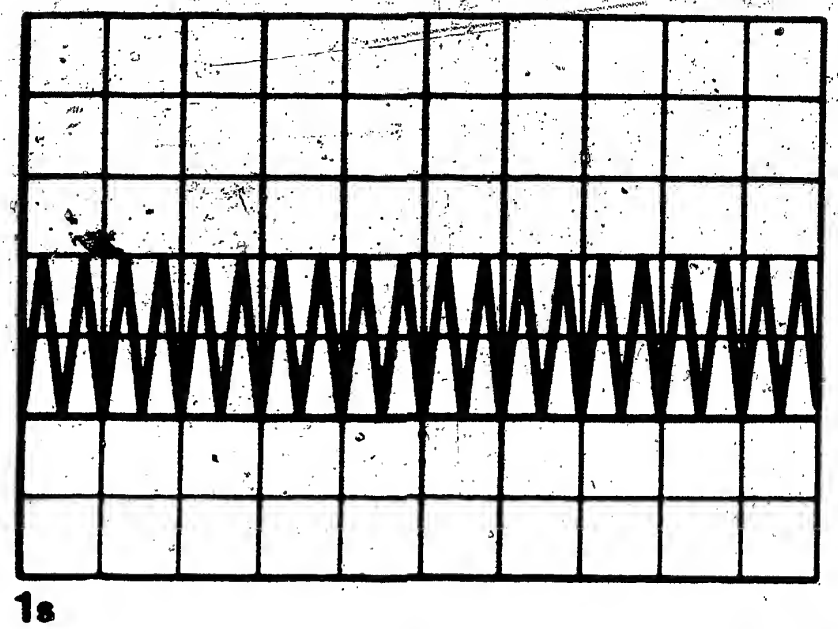
General information:
When evaluating the nozzles, distinguish between new and used nozzles.
Run the chatter test and the spray test one after the other!
Switch the pressure gauge of the nozzle tester off by closing the shutoff valve.
That is necessary to protect the pressure gauge.

New nozzles:
The chatter test makes it possible to test by listening for the ease of movement of the needle valve inside the nozzle body. The readiness with which new nozzles chatter depends upon the nozzle dimensions:
Diameters of seat, guide, and blind hole.
From these are derived groups of chatter characteristics that reproduce the chatter behavior of the nozzles. If a nozzle does not chatter in spite of cleaning, it is to be taken out and replaced with a new nozzle. In the chatter test, the shape of the spray is of no significance. A spray pattern conforming to specifications is generally present only with new nozzles.

Used nozzles:
The chatter behavior of the nozzle deteriorates due to wear in the seat region. For that reason, the groups of chatter characteristics are not to be applied here. The nozzle must chatter audibly when the lever is moved quickly (possibly with a high-pitched whistling tone), and it must spray with good atomization. In an individual case, a hole-type nozzle may still be usable if it chatters audibly (perhaps with a high-pitched whistling tone) or sprays with good atomization. On used nozzles, the spray pattern can deviate from the ideal shape for a new nozzle. It is not possible in every case to conclude that there will be a negative effect on the operation of the engine from this. However, the spray pattern of such nozzles can be improved perceptibly by means of appropriate cleaning actions.

The microfiche cards KP.. (Nozzle Characteristics) contain cross-reference to the group of chatter characteristics according to which the nozzle in question is to be tested.

The diagrams below are to show the movements of the needle valves, and how they chatter in the individual characteristic groups depending upon the speed with which the lever of the nozzle tester is moved.

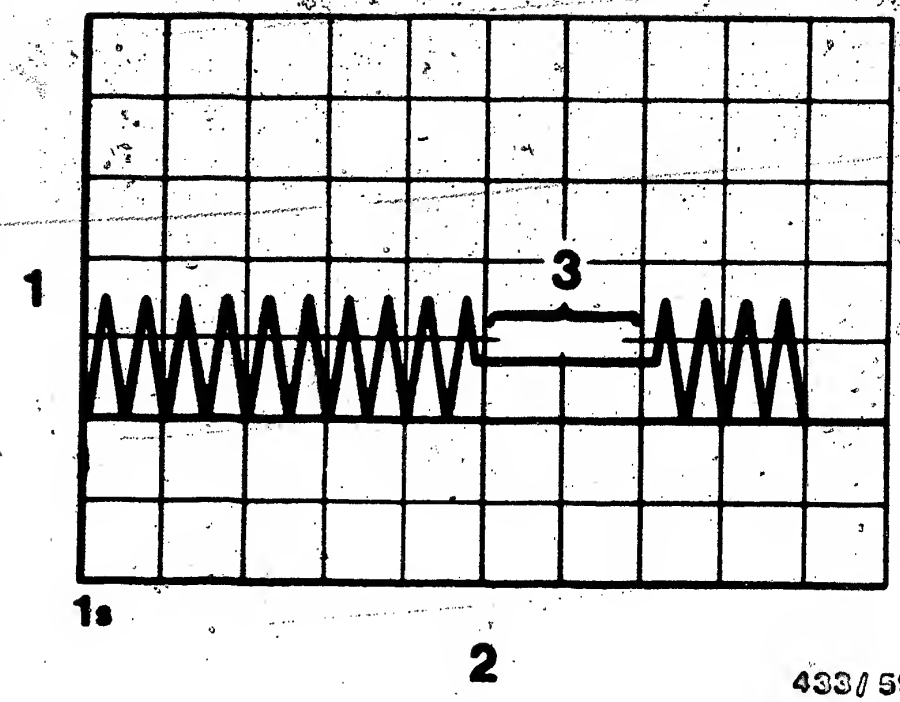


1 = Needle valve
2 = Time for 1 downward stroke movement of the hand lever (increasing testing speed)

Chatter characteristic group I

Chatter behavior:
Chattering well throughout the range of lever speeds that can be attained.
Minimum testing speed:
One downward movement per second.

Spray pattern:
At low testing speeds, broken spray patterns with coarse atomization.
As the lever speed is increased, the sprays become full and finely atomized.

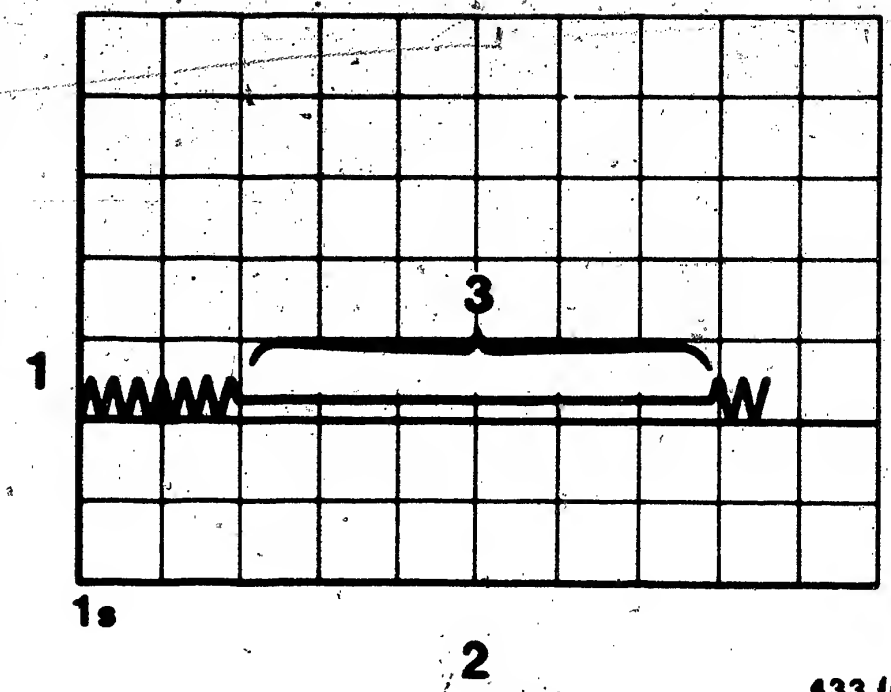


1 = Needle valve stroke
2 = Time for one downward movement of the hand lever (increasing testing speed)
3 = No chatter

Chatter characteristic group II

Chatter behavior:
Chattering well with rapid and slow lever speeds. In between, there can be smaller zones without chatter.

Spray pattern:
At low testing speed, broken sprays with coarse atomization. In the zone with no chatter, non-atomized cord spray. As the lever speed increases, the sprays become full and finely atomized.



1 = Needle valve stroke
2 = Time for one downward movement of the hand lever (increasing testing speed)
3 = No chatter and drips

Chatter characteristic group III

Chatter behavior:
Chattering only with slow or rapid movement of the lever. In between, there is a broad range without chatter.

Spray pattern:
Non-atomized cord spray up to a high testing speed. Then the sprays become full and finely atomized.

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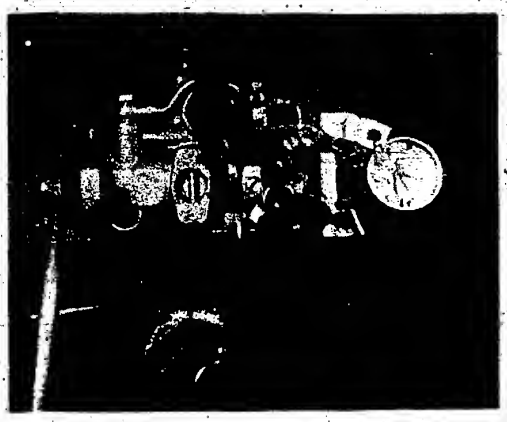


Fig. 1

Fig. 4

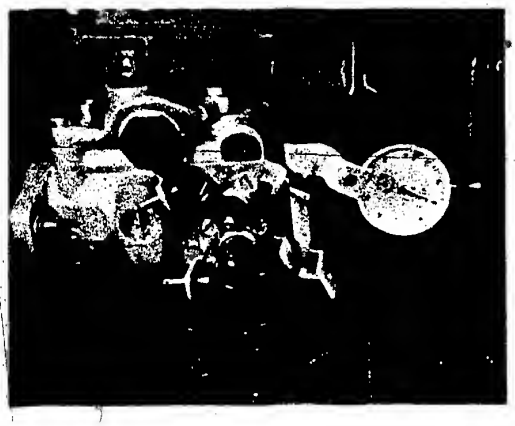


Fig. 2

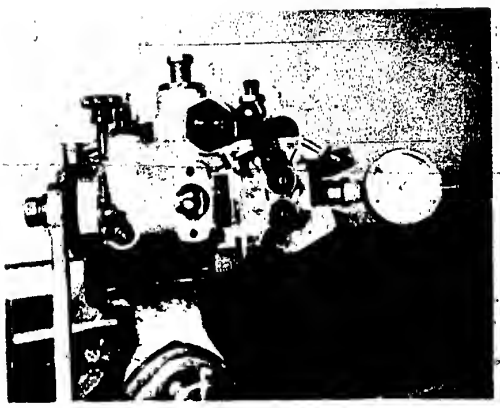


Fig. 5

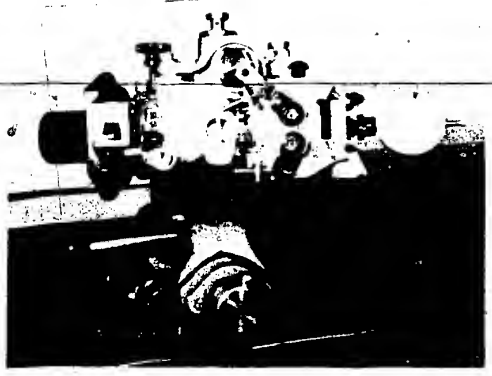


Fig. 3

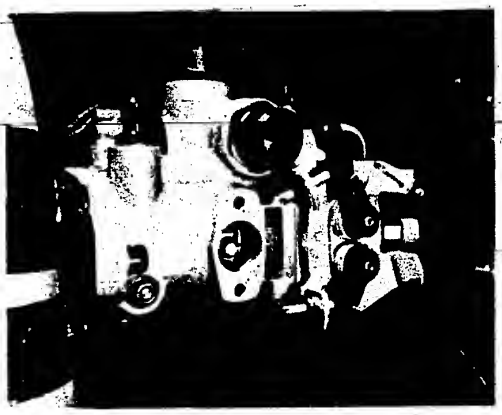


Fig. 6

1.1 "Dial-indicator method"

1.1.1 Preparing the injection pump (Fig. 1)

Remove the central screw plug (vent screw) from the distributor head. The distributor groove on the plunger is now visible and must be set in the direction of the "delivery" outlet.

Install the dial indicator holder 1 688 130 044 (EFEP 466) with gasket in place of the central screw plug. Fit dial indicator 1 687 233 011 (EFAW 7) and in BDC position of the face cam preload approx. 5 mm (0.197 in.) and set it to zero.

Rotate the drive shaft in the direction of rotation until the dial indicator shows the reading given on the relevant pump Test Sheet for (Position for beginning of delivery at plunger stroke ... mm)

Lock the drive shaft in position with lock screw 1 683 453 001 (EFSR 24 Y 3 Z). For this purpose, a bore is provided on the flange between the tubing connections.

1.1.2 Preparing the engine

Set the engine to the delivery timing mark provided by the manufacturer.

1.1.3 Installation of the pump (Fig. 2)

Locate and fasten the pump. Pay attention that the pump is fixed centrally in its long flange slots. Remove the lock screw and re-install the plug.

Then correct

(Position for beginning of delivery at plunger stroke ... mm)

setting and secure the pump. Remove the dial indicator holder and re-install the plug.

N. B. If the pump has to be installed without using the lock screw allowance must be made for a matching drift angle on the engine

(see 1.1.2).

1.2 "Marking-method"

1.2.1 Preparing the injection pump (Fig. 3)

Remove the central screw plug (vent screw) from the distributor head. The distributor groove on the plunger is now visible and must be set in the direction of the "delivery" outlet.

Install the dial indicator holder 1 688 130 044 (EFEP 466) with gasket in place of the central screw plug. Fit dial indicator 1 687 233 011 (EFAW 7) and in BDC position of the face cam preload approx. 5 mm (0.197 in.) and set it to zero.

Rotate the drive shaft in the direction of rotation until the dial indicator shows the reading given on the relevant pump Test Sheet for

(Marking for beginning of delivery at plunger stroke ... mm and ... angle on the marking device)

Lock the drive shaft in position with lock screw 1 683 453 001 (EFSR 24 Y 3 Z). For this purpose, a bore is provided on the flange between the tubing connections.

Set marking device EFEP 164 to the angle specified on the Test Sheet, fasten it on the drive shaft and mark the flange. Thereafter, remove the marking device, dial indicator holder and lock screw and re-install the plugs.

1.2.2 Preparing the engine

A "missing-tooth" pinion is used to couple the engine with the injection pump. In this case, the engine manufacturer has made a mark (Beginning of delivery) on the mounting flange for the injection pump.

1.2.3 Installation of the pump (Fig. 4)

Insert the injection pump and twist it until the marks coincide. Fasten the pump.

1.3 "Pointer method"

1.3.1 Preparing the injection pump (Fig. 5)

Remove the central screw plug (vent screw) from the distributor head. The distributor groove on the plunger is now visible and must be set in the direction of the "delivery" outlet.

Install the dial indicator holder 1 688 130 044 (EFEP 466) with gasket in place of the central screw plug. Fit dial indicator 1 687 233 011 (EFAW 7) and in BDC position of the face cam preload approx. 5 mm (0.197 in.) and set it to zero.

Rotate the drive shaft in the direction of rotation until the dial indicator shows the reading given on the relevant pump Test Sheet for

(Pointer setting for beginning of delivery at plunger stroke ... mm)

Lock the drive shaft in position with lock screw 1 683 453 001 (EFSR 24 Y 3 Z). For this purpose, a bore is provided on the flange between the tubing connections.

Set the adjustment pointer on the roller ring to coincide with the mark on the face cam. Remove the dial indicator holder and re-install the plug.

N. B.: There may be 2 marks on the face cam, the one marked "L" being for a counter-clockwise rotating pump.

1.3.2 Preparing the engine

Set the engine to the timing mark (Beginning of delivery) provided by the manufacturer.

1.3.3 Installation of the pump (Fig. 6)

Insert the injection pump and fasten it. Pay attention that the pump is fixed centrally in the long flange slots. Remove the lock screw and re-install the plug.

Thereafter correct the adjustment (the adjustment pointer must coincide with the corresponding mark on the face cam) and secure the pump. Close the inspection hole.

N. B. If the pump has to be installed without using the lock screw, allowance must be made for a matching drift angle on the engine (see 1.3.2).

2. Venting the injection system

2.1 After the pump is installed, fill it with filtered fuel.

2.2 Vent the fine filter at the vent screw until bubble-free fuel leaks out.

2.3 Vent the pump at the vent screw on the inlet to the distributor head until bubble-free fuel leaks out.

2.4 Vent the pressure chamber in the distributor head at the vent screw (central screw plug) until bubble-free fuel leaks out.

N. B. After the installation steps, it may happen that the pump is set on a delivery stroke and there is no connection between the suction chamber and the pressure chamber; therefore no fuel can leak through the vent screw. In this case, the pump has to be rotated a little farther.

When tightening the vent screw (central screw plug), pay attention that the gasket fits perfectly on the distributor head and that the vent screw is tightened with a torque of 4.5 - 5.5 kgm (32.5 - 39.8 ft. lb.).

2.5 Connect up the high-pressure lines according to the injection sequence. It is recommended that they are tightened only on the pump at first and that the engine is then cranked over to fill them. Thereafter connect up the high-press lines to the nozzle holders.

New Product

0 460 4 . . – VE . . F . . with manifold-pressure compensator (LDA)

VDT-I-460/1 B
Suppl. 2
10. 1977

In the Technical Bulletin VDT-I-460/1 B the function of the distributor-type fuel injection pump VE .. F .. is described.
As a variant to this pump a design with manifold-pressure compensator was established.

1. Manifold-pressure compensator (LDA)

With pressure-charged engines the full-load delivery is regulated by a variable air charge in the engine cylinders dependent on the manifold pressure. In the lower rotational-speed range the air charge in the cylinders is less and the full-load delivery must correspondingly be related to the reduced air charge.

The manifold-pressure compensator serves to reduce the full-load delivery in the lower rotational-speed range starting from a determined (selectable) charge-air pressure.

2. Construction and operation of the manifold-pressure compensator

The LDA is divided into an upper and a lower chamber separated from one another by an air-tight diaphragm. In the cover of the LDA there is a connection for the charge-air pressure.

A helical compression spring operates against the diaphragm from below. This spring is supported on the other side by a threaded adjusting nut. The preload of the spring and the point at which the manifold-pressure compensator becomes effective can thus be changed.

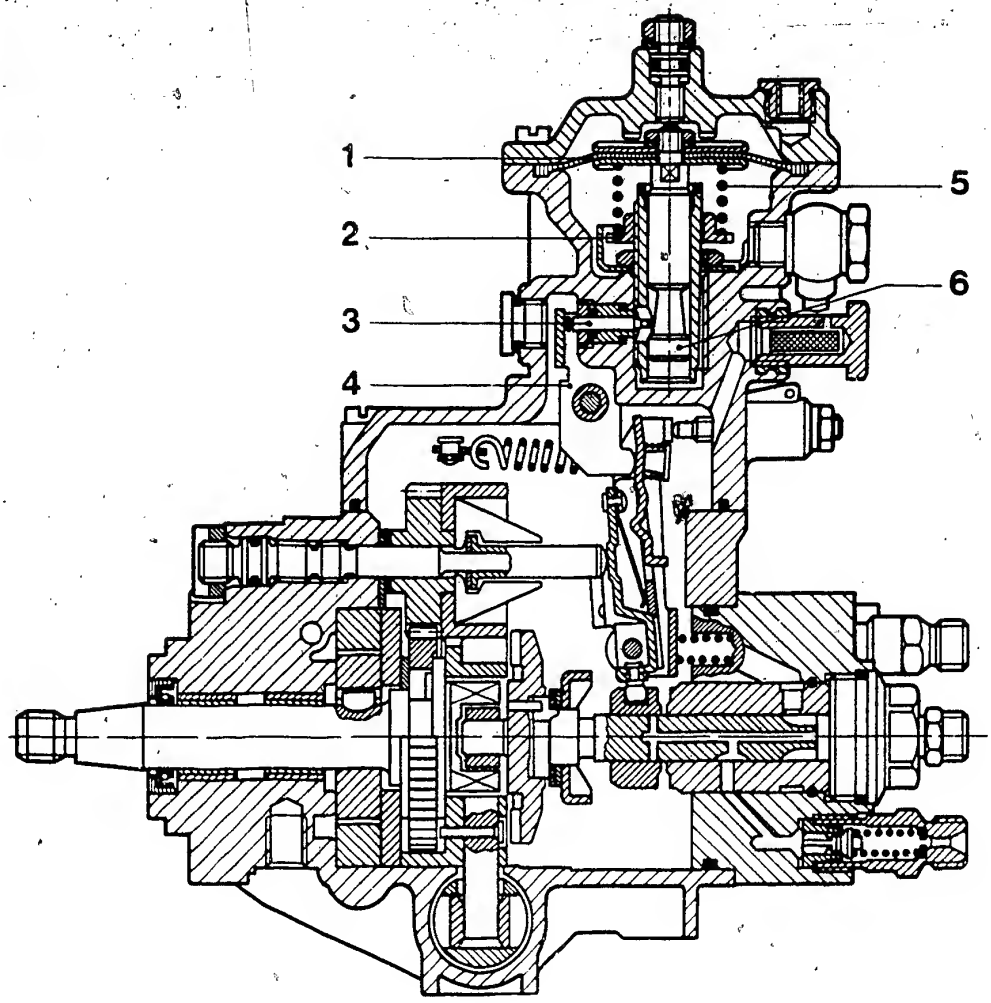
A tapered adjusting pin is attached to the diaphragm with the aid of two plate washers.

The guide pin traces the movements of the adjusting pin taper and conveys them to the compensator, the position of which is thereby altered.

If the charge-air pressure increases with a higher rotational speed, then at a certain pressure the diaphragm will be pressed down a certain amount against the force of the spring. The guide pin is pushed in the direction of the adjusting pin, whereby the compensator moves in the "greater delivery" direction.

At a lower rotational speed or when the supercharger breaks down, the compensator returns to its basic position and limits the full-load delivery such that a smokeless combustion of the fuel can be guaranteed.

J12



1 = diaphragm
2 = adjusting nut
3 = guide pin
4 = stop lever
5 = helical compression spring
6 = adjusting pin

J13

Starting Problems in Vehicles Equipped with Distributor-type Fuel-injection Pumps VE..F..

VDT-I-460/102 B
2.1977

Experience to date has revealed the following possible causes of starting problems in vehicles equipped with VE..F.. distributor-type fuel-injection pumps:

1. Solenoid-operated valve (item 240 in microfiche EP..) is short-circuiting to ground

   If the tightening torque for the M5 nut on the solenoid-operated valve is exceeded, there is the danger of a short-circuit to ground in the solenoid body. We therefore point out thot a tightening torque of 2.5 N·m (0.25 kgf·m) should not be exceeded.

   Remedy: replace solenoid-operated valve.

2. Central screw plug (item 130 in microfiche EP..) allows leaks into the interior

   This results in a drop in starting fuel delivery.

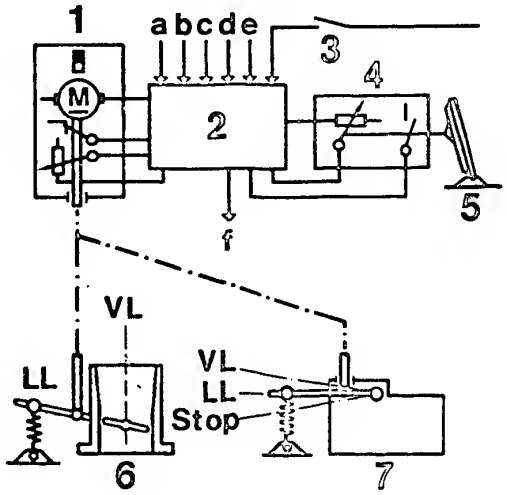
   Remedy: Retighten the central screw plug applying a max. torque of 80 N·m (8.0 kgf·m). Investigations showed that this led to the original starting fuel delivery being re-established.
   If the tightening torque is already 80 N·m (8.0 kgf·m) the screw plug is to be reploced.
   If this measure is not successful, troubleshooting must be continued.

Vehicle agencies distributing vehicles equipped with VE..F.. distributor-type fuel-injection pumps (currently Opel, Peugeot and VW) should be made aware that the pump should not be replaced immediately whenever there are starting problems, but rather that the vehicle should be entrusted to the Bosch Service so that this central screw plug can be retightened (special wrench KDEP 1080 is required). We further request these agencies to refer to the tightening torque of 2.5 N·m (0.25 kgf·m) for the connecting cable at the solenoid-operated valve.

BOSCH
Geschäftsbereich KH Kundendienst, Kfz-Ausrüstung

J14

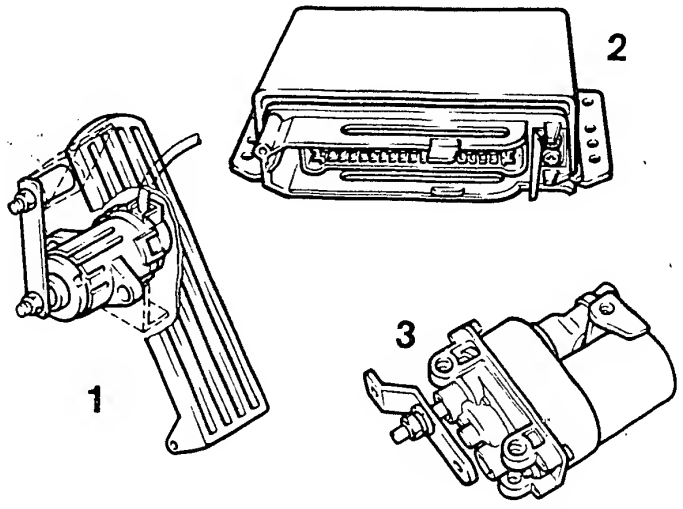
NEW SYSTEM
ELECTRONIC ENGINE-POWER CONTROL (E-GAS)



1 = Servo motor
2 = Control unit
3 = Driving switch
4 = Accelerator-position generator
5 = Accelerator
6 = Throttle valve
7 = Injection pump

LL = Idle
VL = Full load

a = Speed signal
b = Stop lamp
c = Term. 15 (driving switch)
d = Engine brake
e = Cruise control
f = Shutoff cylinder



1 = Accelerator-position generator
2 = Electronic control unit
3 = Servo motor

1. General

The electronic engine-power control (E-Gas) is an electronic servo system for the fuel-injection pump or the throttle valve. It has been installed since September 1985 in SETRA buses made by Kässbohrer under the designation EFR-Tempomat.

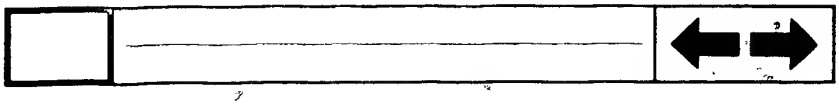
2. Construction

The E-Gas system comprises an accelerator-position generator, a servo motor and the electronic control unit.

The E-Gas system makes it possible to realize the following functions:

- Replacement for mechanical linkage (transmission ratio 1:1)*
- Cruise control;* maximum-speed limitation.*
- Idle-speed increase*; idle-speed control
- Driving disable (idle safeguard)*
- Non-linear accelerator transmission characteristics (consumption-optimized acceleration)
- Temperature-sensitive maximum rpm limitation; limitation to engine speed optimum for consumption (with kick-down override)
- Rpm control for auxiliaries
- Rolling-start disable (key-operated shutoff)
- Start-repeat disable
- Engine-brake control (rpm-sensitive)
- Transmission control
- Anti-jackknifing for articulated vehicles
- Self-adjusting system to compensate for pump tolerances
- Electronic traction control

The functions identified by * have been realized in the E-Gas system for Kässbohrer (EFR-Tempomat).



3. Operating principle

The position of the accelerator is converted into an electrical signal by the accelerator-position generator. In the electronic control unit, taking account of a number of preprogrammed factors and signals from other generators (engine speed, temperature, vehicle speed etc.), this setpoint value is converted into a pulsed control voltage for the servo motor. The servo motor actuates the injection-pump control lever or the throttle valve.

4. Safety concept

The E-Gas system is monitored by a safety logic, so that, in the event of any malfunctions, the engine is in most cases set to idling.
Merely for the malfunctions:
- actuator jammed in load position and
- fault in position feedback monitoring of actuator

is the engine switched off by a second safety element (shutoff cylinder or spring, or shutting off of fuel supply).
All safety switchoffs are made ineffective if the malfunction disappears again by itself or if the accelerator is actuated. This makes it possible to drive as far as the nearest garage.

Please direct questions and comments concerning the contents to our authorized representative in your country.

40...46,58

ENGINE KNOCKING AT PART LOAD

VDT-I-434/100 En
1.1986

in Mercedes-Benz passenger cars, off-road vehicles and commercial vehicles

If, with the engine at normal operating temperature, the complaint "engine knocking" occurs on the above-quoted vehicles with engines OM 615, 616, 617, an improvement can be obtained by installing the flat-type pintle nozzle DN 0 SD 261 (0 434 250 120).

The nozzle DN 0 SD 261 is also installed in the 190 D (engine OM 601).

The nozzles should be replaced in sets.

The work is subject to payment.

Published by:

ROBERT BOSCH GMBH
Division KH
Technical After-Sales Service (KH/VKD 2)

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Technical Bulletin

J19

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Quiet-idle device leakage test

The quiet-idle device leakage test can be carried out either in the vehicle or on the test bench.

1. Leakage test in the vehicle

1.1 The linkage between the quiet-idle device and the operating lever must be disconnected.
Note: The quiet-idle device lever must not be removed.

1.2 Remove the hose from the quiet-idle device.

1.3 Push a transparent hose onto the quiet-idle device fitting for the purpose of measuring the leakage fuel.

1.4 Position the quiet-idle device lever exactly vertically, pointing upwards towards the return fitting (see fig. 1). The quiet-idle device has thus been put out of action.

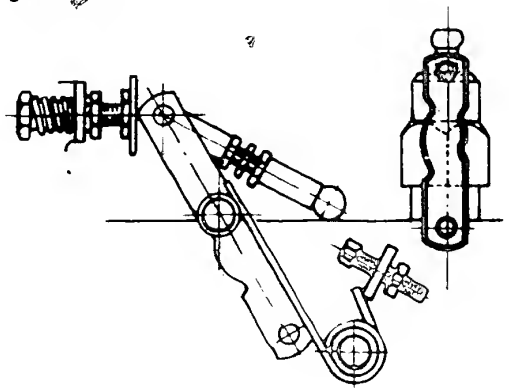
1.5 Set the engine to idle speed.

1.6 Measure the overflow quantity with a suitable measuring glass. In so doing ensure that the fuel flows uniformly out of the hose during the measurement.

1.7 Test value:
Permissible leakage quantity = max. 6 cm^3 during measurement time of 3 mins.

1.8 If the permitted value is exeeded, the quiet-idle device must be replaced.
Tightening torque for central screw plug: 40 - 60 N.m (4 - 6 kgf.m).

1.9 The linkage should be set in accordance with VDT-BMP 161/36 B.



2. Leakage test on the test bench

2.1 The linkage between the quiet-idle device and the operating lever must be disconnected.
Note: The quiet-idle device lever must not be removed.

2.2 Push a transparent hose onto the quiet-idle device fitting for the purpose of measuring the leakage fuel.

2.3 Position the quiet-idle device lever exactly vertically, pointing upwards towards the return fitting (see fig. 1).
The quiet-idle device has thus been put out of action.

2.4 Drive the distributor-type pump at the full-load speed given under point 1.6 "full-load speed regulation" in the test specification sheet. Push the speed-control lever up against the end stop.

2.5 Measure the overflow quantity with a suitable measuring glass. In so doing ensure that the fuel flows uniformly out of the hose during the measurement.

2.6 Test value:
Permissible leakage quantity = max. 3.5 cm^3 during measurement time of 1 min.

2.7 If the permitted value is exceeded, the quiet-idle device must be replaced.
Tightening torque for central screw plug: 40 - 60 N.m (4 - 6 kgf.m).

2.8 The linkage must be set in accordance with VDT-WPP 161/4 B 1st. suppl. para. 1.

TIMING-DEVICE MODIFICATION

VDT-I-460/121-EN

2.1981

on VA 6/100 F 1000 CR 199 or CR 199 P
(IHC engine D 310)

In order to prevent misfiring and the formation of white smoke on International Harvester tractors fitted with the D 310 engine, the VA 6/100 H 1000 CR 199 and the CR 199 P distributor-type fuel-injection pumps have been modified by increasing the timing-device adjustment range by 3°.

Until FD 922 (date of manufacture Feb. 1979), the timing-device piston was adjusted with a setting of 3° "advance". In order to shift the nominal start of pump delivery to 6° "advance", a shim was fitted between the spring cover of the timing device and the housing. A different spring (Item No. 26 on the Service Parts List, Part Number 1 464 618 005) was also fitted. These modified pumps are marked as follows: VA...CR 199 A or CR 199 PA:

As from FD 922, distributor pumps are delivered ex-works with the timing-device piston and the spring (but without shim) already set to 6° "advance". Modified distributor pumps with the code VA 6...199A which are received by service stations and which require a thorough overhaul, must be fitted with a new housing and new timing-device piston (Part Number 1 456 120 983) whereby the shim is to be removed.

Warranty:

Costs are to be borne by the customer. Warranty claims cannot be accepted.

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